

## **ANEXO A.**

### **DATOS TOPOGRÁFICOS PARA LA OBTENCIÓN DEL IRI ZONA URBANA MÉTODO TRADICIONAL DE MEDICIÓN DEL IRI (MIRA Y NIVEL DE INGENIERO)**

**Código del tramo: 01**

**Longitud del Tramo: 100 metros.**

**Nombre del tramo: Av. Jesús Molina (Cruce ruta San Jacinto - Casa del Mariachi)**

**Abscisa del tramo inicial: 0 m.**

**Abscisa del tramo final: 100 m.**

**Carril de ida**

**Huella 1**

Nº	PUNTO	V.AT	AL.INS	V.AD	COTA	Nº	PUNTO	V.AT	AL.INS	V.AD	COTA
1	0	1.303	1910.303		1909	41	20			1.3432	1908.960
2	0.5			1.3027	1909.000	42	20.5			1.3459	1908.957
3	1			1.3024	1909.001	43	21			1.3486	1908.954
4	1.5			1.302	1909.001	44	21.5			1.3516	1908.951
5	2			1.3015	1909.002	45	22			1.3545	1908.949
6	2.5			1.3004	1909.003	46	22.5			1.354	1908.949
7	3			1.2992	1909.004	47	23			1.3534	1908.950
8	3.5			1.2983	1909.005	48	23.5			1.3594	1908.944
9	4			1.2973	1909.006	49	24			1.3654	1908.938
10	4.5			1.298	1909.005	50	24.5			1.3668	1908.936
11	5			1.2987	1909.004	51	25			1.3682	1908.935
12	5.5			1.2987	1909.004	52	25.5			1.368	1908.935
13	6			1.2986	1909.004	53	26			1.3677	1908.935
14	6.5			1.2998	1909.003	54	26.5			1.3683	1908.935
15	7			1.3009	1909.002	55	27			1.3688	1908.934
16	7.5			1.3006	1909.002	56	27.5			1.3706	1908.932
17	8			1.3003	1909.003	57	28			1.3723	1908.931
18	8.5			1.3005	1909.003	58	28.5			1.3739	1908.929
19	9			1.3006	1909.002	59	29			1.3754	1908.928
20	9.5			1.3007	1909.002	60	29.5			1.3758	1908.927
21	10			1.3008	1909.002	61	30			1.3761	1908.927
22	10.5			1.302	1909.001	62	30.5			1.3778	1908.925
23	11			1.3031	1909.000	63	31			1.3795	1908.924
24	11.5			1.3043	1908.999	64	31.5			1.38	1908.923
25	12			1.3054	1908.998	65	32			1.3804	1908.923
26	12.5			1.3076	1908.995	66	32.5			1.3844	1908.919
27	13			1.3098	1908.993	67	33			1.3844	1908.919
28	13.5			1.3127	1908.990	68	33.5			1.3855	1908.918
29	14			1.3156	1908.987	69	34			1.3865	1908.917
30	14.5			1.3187	1908.984	70	34.5			1.3869	1908.916
31	15			1.3218	1908.981	71	35			1.3873	1908.916
32	15.5			1.3229	1908.980	72	35.5			1.3872	1908.916
33	16			1.324	1908.979	73	36			1.3871	1908.916
34	16.5			1.3261	1908.977	74	36.5			1.3871	1908.916
35	17			1.3282	1908.975	75	37			1.3871	1908.916
36	17.5			1.3285	1908.975	76	37.5			1.3868	1908.916
37	18			1.3287	1908.974	77	38			1.3865	1908.917
38	18.5			1.3312	1908.972	78	38.5			1.3881	1908.915
39	19			1.3336	1908.969	79	39			1.3896	1908.913
40	19.5			1.3384	1908.965	80	39.5			1.3905	1908.913

Nº	PUNTO	V.AT	AL.INS	V.AD	COTA
81	40			1.3913	1908.912
82	40.5			1.3924	1908.911
83	41			1.3935	1908.910
84	41.5			1.3962	1908.907
85	42			1.3988	1908.904
86	42.5			1.4004	1908.903
87	43			1.402	1908.901
88	43.5			1.4017	1908.901
89	44			1.4013	1908.902
90	44.5			1.4013	1908.902
91	45			1.4012	1908.902
92	45.5			1.4026	1908.900
93	46			1.4039	1908.899
94	46.5			1.4057	1908.897
95	47			1.4075	1908.896
96	47.5			1.4088	1908.894
97	48			1.4101	1908.893
98	48.5			1.4077	1908.895
99	49			1.4052	1908.898
100	49.5			1.4054	1908.898
101	50			1.4056	1908.897
102	50.5			1.4063	1908.897
103	51			1.4069	1908.896
104	51.5			1.4074	1908.896
105	52			1.4078	1908.895
106	52.5			1.4068	1908.896
107	53			1.4058	1908.897
108	53.5			1.4063	1908.897
109	54			1.4067	1908.896
110	54.5			1.405	1908.898
111	55			1.4032	1908.900
112	55.5			1.4014	1908.902
113	56			1.3996	1908.903
114	56.5			1.4017	1908.901
115	57			1.4038	1908.899
116	57.5			1.4037	1908.899
117	58	1.3803	1910.28	1.4035	1908.900
118	58.5			1.3977	1908.882
119	59			1.3919	1908.888
120	59.5			1.3802	1908.900
121	60			1.384	1908.896
122	60.5			1.384	1908.896
123	61			1.384	1908.896
124	61.5			1.384	1908.896
125	62			1.384	1908.896
126	62.5			1.384	1908.896
127	63			1.384	1908.896
128	63.5			1.384	1908.896
129	64			1.384	1908.896
130	64.5			1.384	1908.896

Nº	PUNTO	V.AT	AL.INS	V.AD	COTA
131	65			1.3852	1908.895
132	65.5			1.3856	1908.894
133	66			1.387	1908.893
134	66.5			1.3883	1908.892
135	67			1.3895	1908.890
136	67.5			1.3907	1908.889
137	68			1.3896	1908.890
138	68.5			1.3885	1908.891
139	69			1.3842	1908.896
140	69.5			1.3899	1908.890
141	70			1.388	1908.892
142	70.5			1.386	1908.894
143	71			1.385	1908.895
144	71.5			1.384	1908.896
145	72			1.3833	1908.897
146	72.5			1.3825	1908.897
147	73			1.3827	1908.897
148	73.5			1.3828	1908.897
149	74			1.3816	1908.898
150	74.5			1.3804	1908.899
151	75			1.3787	1908.901
152	75.5			1.3769	1908.903
153	76			1.377	1908.903
154	76.5			1.377	1908.903
155	77			1.3774	1908.902
156	77.5			1.3778	1908.902
157	78			1.3786	1908.901
158	78.5			1.3793	1908.901
159	79			1.3797	1908.900
160	79.5			1.3781	1908.902
161	80			1.3788	1908.901
162	80.5			1.3794	1908.900
163	81			1.3791	1908.901
164	81.5			1.3787	1908.901
165	82			1.379	1908.901
166	82.5			1.3792	1908.901
167	83			1.3804	1908.899
168	83.5			1.3816	1908.898
169	84			1.382	1908.898
170	84.5			1.3823	1908.898
171	85			1.3838	1908.896
172	85.5			1.3853	1908.895
173	86			1.3856	1908.894
174	86.5			1.3859	1908.894
175	87			1.3854	1908.894
176	87.5			1.3848	1908.895
177	88			1.3865	1908.893
178	88.5			1.3881	1908.892
179	89			1.3874	1908.892
180	89.5			1.3866	1908.893

N°	PUNTO	V.AT	AL.INS	V.AD	COTA
181	90			1.3869	1908.893
182	90.5			1.3872	1908.893
183	91			1.3851	1908.895
184	91.5			1.383	1908.897
185	92			1.3849	1908.895
186	92.5			1.3867	1908.893
187	93			1.3881	1908.892
188	93.5			1.3895	1908.890
189	94			1.3914	1908.888
190	94.5			1.3932	1908.887
191	95			1.3949	1908.885
192	95.5			1.3966	1908.883
193	96			1.3966	1908.883
194	96.5			1.3965	1908.883
195	97			1.3982	1908.882
196	97.5			1.3998	1908.880
197	98			1.3995	1908.880
198	98.5			1.3991	1908.881
199	99			1.3988	1908.881
200	99.5			1.3984	1908.881
201	100			1.3976	1908.882

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Ing. Chambi Gareca Pablo  
**RESPONSABLE DEL LABORATORIA DE  
TOPOGRAFÍA**  
**FACULTAD DE CIENCIAS Y TEGNOLOGÍA**

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Univ. Ramos Quispe Alejandra  
**ESTUDIANTE CIV 502**  
**FACULTAD DE CIENCIAS Y TEGNOLOGÍA**

**Código del tramo: 01**

**Longitud del Tramo: 100 metros.**

**Nombre del tramo: Av. Jesús Molina (Cruce ruta San Jacinto - Casa del Mariachi)**

**Abscisa del tramo inicial: 0 m.**

**Abscisa del tramo final: 100 m.**

**Carril de ida**

**Huella 2**

N°	PUNTO	V.AT	AL.INS	V.AD	COTA	N°	PUNTO	V.AT	AL.INS	V.AD	COTA
1	0	1.277	1911.277		1910	41	20			1.321	1909.956
2	0.5			1.278	1909.999	42	20.5			1.325	1909.952
3	1			1.279	1909.998	43	21			1.328	1909.949
4	1.5			1.280	1909.996	44	21.5			1.329	1909.948
5	2			1.282	1909.995	45	22			1.330	1909.946
6	2.5			1.284	1909.993	46	22.5			1.332	1909.944
7	3			1.286	1909.991	47	23			1.334	1909.942
8	3.5			1.286	1909.991	48	23.5			1.337	1909.940
9	4			1.286	1909.991	49	24			1.339	1909.938
10	4.5			1.287	1909.990	50	24.5			1.342	1909.935
11	5			1.287	1909.990	51	25			1.344	1909.933
12	5.5			1.287	1909.990	52	25.5			1.342	1909.935
13	6			1.286	1909.990	53	26			1.340	1909.937
14	6.5			1.286	1909.991	54	26.5			1.341	1909.936
15	7			1.285	1909.992	55	27			1.342	1909.934
16	7.5			1.285	1909.992	56	27.5			1.343	1909.934
17	8			1.284	1909.992	57	28			1.344	1909.933
18	8.5			1.284	1909.993	58	28.5			1.345	1909.932
19	9			1.283	1909.994	59	29			1.346	1909.931
20	9.5			1.284	1909.993	60	29.5			1.347	1909.929
21	10			1.285	1909.991	61	30			1.349	1909.928
22	10.5			1.285	1909.992	62	30.5			1.351	1909.926
23	11			1.285	1909.992	63	31			1.353	1909.924
24	11.5			1.286	1909.991	64	31.5			1.355	1909.922
25	12			1.286	1909.990	65	32			1.357	1909.920
26	12.5			1.286	1909.990	66	32.5			1.358	1909.919
27	13			1.286	1909.990	67	33			1.359	1909.918
28	13.5			1.291	1909.986	68	33.5			1.362	1909.915
29	14			1.295	1909.981	69	34			1.365	1909.912
30	14.5			1.298	1909.978	70	34.5			1.367	1909.910
31	15			1.302	1909.975	71	35			1.369	1909.908
32	15.5			1.304	1909.973	72	35.5			1.369	1909.907
33	16			1.306	1909.971	73	36			1.370	1909.906
34	16.5			1.307	1909.970	74	36.5			1.372	1909.905
35	17			1.308	1909.968	75	37			1.374	1909.903
36	17.5			1.310	1909.967	76	37.5			1.375	1909.902
37	18			1.311	1909.966	77	38			1.375	1909.901
38	18.5			1.314	1909.963	78	38.5			1.376	1909.900
39	19			1.316	1909.960	79	39			1.377	1909.900
40	19.5			1.319	1909.958	80	39.5			1.378	1909.899

N°	PUNTO	V.AT	AL.INS	V.AD	COTA
81	40			1.379	1909.898
82	40.5			1.380	1909.897
83	41			1.381	1909.896
84	41.5			1.381	1909.896
85	42			1.380	1909.896
86	42.5			1.381	1909.896
87	43			1.381	1909.895
88	43.5			1.380	1909.897
89	44			1.379	1909.898
90	44.5			1.379	1909.898
91	45			1.378	1909.898
92	45.5			1.380	1909.897
93	46			1.381	1909.896
94	46.5			1.382	1909.895
95	47			1.383	1909.894
96	47.5			1.384	1909.893
97	48			1.385	1909.892
98	48.5			1.387	1909.890
99	49			1.389	1909.888
100	49.5			1.387	1909.889
101	50			1.386	1909.891
102	50.5			1.381	1909.896
103	51			1.376	1909.901
104	51.5			1.379	1909.898
105	52			1.381	1909.895
106	52.5			1.383	1909.894
107	53			1.385	1909.892
108	53.5			1.384	1909.892
109	54			1.384	1909.893
110	54.5			1.382	1909.895
111	55			1.380	1909.897
112	55.5			1.381	1909.896
113	56			1.382	1909.895
114	56.5			1.382	1909.894
115	57			1.383	1909.894
116	57.5			1.387	1909.890
117	58	1.367	1911.254	1.390	1909.886
118	58.5			1.380	1909.874
119	59			1.369	1909.885
120	59.5			1.367	1909.886
121	60			1.367	1909.887
122	60.5			1.367	1909.887
123	61			1.366	1909.888
124	61.5			1.366	1909.888
125	62			1.368	1909.886
126	62.5			1.370	1909.884
127	63			1.370	1909.884
128	63.5			1.371	1909.883
129	64			1.373	1909.881
130	64.5			1.375	1909.879

N°	PUNTO	V.AT	AL.INS	V.AD	COTA
131	65			1.374	1909.880
132	65.5			1.373	1909.881
133	66			1.374	1909.879
134	66.5			1.376	1909.878
135	67			1.376	1909.878
136	67.5			1.376	1909.878
137	68			1.376	1909.878
138	68.5			1.376	1909.877
139	69			1.375	1909.879
140	69.5			1.373	1909.880
141	70			1.374	1909.880
142	70.5			1.374	1909.880
143	71			1.372	1909.881
144	71.5			1.371	1909.883
145	72			1.371	1909.883
146	72.5			1.370	1909.883
147	73			1.370	1909.884
148	73.5			1.370	1909.884
149	74			1.370	1909.884
150	74.5			1.369	1909.884
151	75			1.367	1909.886
152	75.5			1.365	1909.888
153	76			1.363	1909.891
154	76.5			1.361	1909.893
155	77			1.362	1909.892
156	77.5			1.364	1909.890
157	78			1.364	1909.890
158	78.5			1.363	1909.891
159	79			1.321	1909.933
160	79.5			1.361	1909.893
161	80			1.360	1909.893
162	80.5			1.360	1909.894
163	81			1.360	1909.894
164	81.5			1.359	1909.894
165	82			1.361	1909.893
166	82.5			1.362	1909.892
167	83			1.364	1909.890
168	83.5			1.366	1909.888
169	84			1.365	1909.889
170	84.5			1.365	1909.889
171	85			1.365	1909.888
172	85.5			1.366	1909.888
173	86			1.365	1909.889
174	86.5			1.364	1909.890
175	87			1.362	1909.892
176	87.5			1.360	1909.893
177	88			1.361	1909.893
178	88.5			1.361	1909.893
179	89			1.360	1909.894
180	89.5			1.358	1909.896

N°	PUNTO	V.AT	AL.INS	V.AD	COTA
181	90			1.358	1909.896
182	90.5			1.358	1909.896
183	91			1.359	1909.895
184	91.5			1.360	1909.894
185	92			1.360	1909.894
186	92.5			1.359	1909.894
187	93			1.360	1909.894
188	93.5			1.361	1909.893
189	94			1.361	1909.893
190	94.5			1.361	1909.893
191	95			1.362	1909.891
192	95.5			1.364	1909.890
193	96			1.364	1909.890
194	96.5			1.365	1909.889
195	97			1.364	1909.889
196	97.5			1.364	1909.890
197	98			1.365	1909.889
198	98.5			1.365	1909.889
199	99			1.364	1909.890
200	99.5			1.362	1909.892
201	100			1.361	1909.892

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Ing. Chambi Gareca Pablo

**RESPONSABLE DEL LABORATORIA DE  
TOPOGRAFÍA**

**FACULTAD DE CIENCIAS Y TEGNOLOGÍA**

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Univ. Ramos Quispe Alejandra

**ESTUDIANTE CIV 502**

**FACULTAD DE CIENCIAS Y TEGNOLOGÍA**

**Código del tramo:** 01

**Longitud del Tramo:** 100 metros.

**Nombre del tramo:** Av. Jesús Molina (Cruce ruta San Jacinto - Casa del Mariachi)

**Abscisa del tramo inicial:** 0 m.

**Abscisa del tramo final:** 100 m.

**Carril de vuelta**

**Huella 1**

Nº	PUNTO	V.AT	AL.INS	V.AD	COTA
1	0	1.304	1933.304		1932.000
2	0.5			1.304	1932.000
3	1			1.304	1932.001
4	1.5			1.303	1932.002
5	2			1.302	1932.003
6	2.5			1.300	1932.004
7	3			1.299	1932.006
8	3.5			1.298	1932.007
9	4			1.297	1932.008
10	4.5			1.296	1932.008
11	5			1.295	1932.009
12	5.5			1.296	1932.008
13	6			1.297	1932.007
14	6.5			1.299	1932.005
15	7			1.301	1932.003
16	7.5			1.302	1932.003
17	8			1.302	1932.003
18	8.5			1.302	1932.002
19	9			1.303	1932.002
20	9.5			1.303	1932.002
21	10			1.303	1932.002
22	10.5			1.304	1932.001
23	11			1.305	1932.000
24	11.5			1.305	1931.999
25	12			1.306	1931.999
26	12.5			1.308	1931.996
27	13			1.310	1931.994
28	13.5			1.312	1931.993
29	14			1.314	1931.991
30	14.5			1.318	1931.986
31	15			1.322	1931.982
32	15.5			1.326	1931.978
33	16			1.330	1931.975
34	16.5			1.330	1931.974
35	17			1.330	1931.974
36	17.5			1.331	1931.974
37	18			1.331	1931.973
38	18.5			1.333	1931.971
39	19			1.335	1931.970
40	19.5			1.340	1931.964

Nº	PUNTO	V.AT	AL.INS	V.AD	COTA
41	20			1.345	1931.959
42	20.5			1.352	1931.952
43	21			1.350	1931.955
44	21.5			1.357	1931.948
45	22			1.357	1931.948
46	22.5			1.357	1931.947
47	23			1.358	1931.947
48	23.5			1.362	1931.942
49	24			1.366	1931.938
50	24.5			1.367	1931.937
51	25			1.369	1931.936
52	25.5			1.368	1931.936
53	26			1.368	1931.936
54	26.5			1.369	1931.936
55	27			1.369	1931.935
56	27.5			1.370	1931.934
57	28			1.371	1931.933
58	28.5			1.372	1931.933
59	29			1.372	1931.932
60	29.5			1.375	1931.929
61	30			1.378	1931.926
62	30.5			1.379	1931.925
63	31			1.380	1931.925
64	31.5			1.383	1931.921
65	32			1.386	1931.918
66	32.5			1.386	1931.918
67	33			1.386	1931.918
68	33.5			1.387	1931.917
69	34			1.388	1931.917
70	34.5			1.388	1931.916
71	35			1.388	1931.916
72	35.5			1.388	1931.916
73	36			1.388	1931.916
74	36.5			1.388	1931.916
75	37			1.388	1931.916
76	37.5			1.388	1931.917
77	38			1.387	1931.917
78	38.5			1.388	1931.916
79	39			1.389	1931.916
80	39.5			1.391	1931.914



N°	PUNTO	V.AT	AL.INS	V.AD	COTA	N°	PUNTO	V.AT	AL.INS	V.AD	COTA
81	40			1.393	1931.912	131	65			1.386	1931.913
82	40.5			1.393	1931.911	132	65.5			1.386	1931.912
83	41			1.394	1931.910	133	66			1.387	1931.912
84	41.5			1.396	1931.908	134	66.5			1.389	1931.910
85	42			1.398	1931.907	135	67			1.390	1931.909
86	42.5			1.400	1931.904	136	67.5			1.390	1931.909
87	43			1.403	1931.902	137	68			1.390	1931.909
88	43.5			1.402	1931.902	138	68.5			1.387	1931.911
89	44			1.402	1931.903	139	69			1.384	1931.914
90	44.5			1.402	1931.903	140	69.5			1.386	1931.913
91	45			1.401	1931.903	141	70			1.388	1931.911
92	45.5			1.403	1931.902	142	70.5			1.387	1931.912
93	46			1.404	1931.900	143	71			1.386	1931.913
94	46.5			1.406	1931.898	144	71.5			1.385	1931.914
95	47			1.408	1931.896	145	72			1.385	1931.914
96	47.5			1.411	1931.894	146	72.5			1.384	1931.915
97	48			1.413	1931.892	147	73			1.383	1931.916
98	48.5			1.410	1931.895	148	73.5			1.382	1931.917
99	49			1.407	1931.898	149	74			1.382	1931.917
100	49.5			1.407	1931.898	150	74.5			1.380	1931.918
101	50			1.406	1931.898	151	75			1.379	1931.920
102	50.5			1.407	1931.898	152	75.5			1.379	1931.920
103	51			1.407	1931.897	153	76			1.378	1931.921
104	51.5			1.407	1931.897	154	76.5			1.378	1931.921
105	52			1.408	1931.897	155	77			1.378	1931.921
106	52.5			1.407	1931.897	156	77.5			1.378	1931.921
107	53			1.406	1931.898	157	78			1.379	1931.920
108	53.5			1.407	1931.898	158	78.5			1.379	1931.920
109	54			1.407	1931.897	159	79			1.380	1931.919
110	54.5			1.406	1931.898	160	79.5			1.379	1931.919
111	55			1.405	1931.900	161	80			1.379	1931.920
112	55.5			1.252	1932.052	162	80.5			1.379	1931.920
113	56			1.400	1931.905	163	81			1.379	1931.919
114	56.5			1.402	1931.902	164	81.5			1.379	1931.920
115	57			1.404	1931.900	165	82			1.379	1931.920
116	57.5			1.404	1931.900	166	82.5			1.380	1931.919
117	58	1.398	1933.3	1.404	1931.901	167	83			1.381	1931.918
118	58.5			1.398	1931.901	168	83.5			1.382	1931.917
119	59			1.392	1931.906	169	84			1.383	1931.916
120	59.5			1.386	1931.912	170	84.5			1.383	1931.916
121	60			1.380	1931.918	171	85			1.384	1931.915
122	60.5			1.380	1931.919	172	85.5			1.385	1931.914
123	61			1.379	1931.920	173	86			1.386	1931.913
124	61.5			1.379	1931.920	174	86.5			1.386	1931.913
125	62			1.379	1931.919	175	87			1.386	1931.913
126	62.5			1.381	1931.918	176	87.5			1.386	1931.913
127	63			1.382	1931.917	177	88			1.387	1931.912
128	63.5			1.383	1931.916	178	88.5			1.387	1931.911
129	64			1.384	1931.915	179	89			1.388	1931.911
130	64.5			1.385	1931.914	180	89.5			1.388	1931.911

N°	PUNTO	V.AT	AL.INS	V.AD	COTA
181	90			1.387	1931.912
182	90.5			1.386	1931.913
183	91			1.385	1931.913
184	91.5			1.385	1931.914
185	92			1.385	1931.914
186	92.5			1.387	1931.912
187	93			1.388	1931.910
188	93.5			1.390	1931.909
189	94			1.392	1931.907
190	94.5			1.394	1931.905
191	95			1.395	1931.904
192	95.5			1.396	1931.903
193	96			1.396	1931.902
194	96.5			1.398	1931.901
195	97			1.399	1931.900
196	97.5			1.399	1931.900
197	98			1.400	1931.899
198	98.5			1.399	1931.900
199	99			1.399	1931.900
200	99.5			1.398	1931.901
201	100			1.398	1931.901

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 Ing. Chambi Gareca Pablo

**RESPONSABLE DEL LABORATORIA DE  
 TOPOGRAFÍA**

**FACULTAD DE CIENCIAS Y TEGNOLOGÍA**

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 Univ. Ramos Quispe Alejandra

**ESTUDIANTE CIV 502**

**FACULTAD DE CIENCIAS Y TEGNOLOGÍA**

**Código del tramo:** 01

**Longitud del Tramo:** 100 metros.

**Nombre del tramo:** Av. Jesús Molina (Cruce ruta San Jacinto - Casa del Mariachi)

**Abscisa del tramo inicial:** 0 m.

**Abscisa del tramo final:** 100 m.

**Carril de vuelta**

**Huella 2**

Nº	PUNTO	V.AT	AL.INS	V.AD	COTA	Nº	PUNTO	V.AT	AL.INS	V.AD	COTA
1	0	1.280	1934.280		1933	41	20			1.322	1932.959
2	0.5			1.281	1933.000	42	20.5			1.325	1932.956
3	1			1.281	1932.999	43	21			1.328	1932.953
4	1.5			1.282	1932.998	44	21.5			1.329	1932.951
5	2			1.283	1932.998	45	22			1.330	1932.950
6	2.5			1.284	1932.996	46	22.5			1.333	1932.948
7	3			1.286	1932.994	47	23			1.335	1932.945
8	3.5			1.286	1932.994	48	23.5			1.338	1932.942
9	4			1.286	1932.994	49	24			1.342	1932.938
10	4.5			1.287	1932.994	50	24.5			1.343	1932.937
11	5			1.287	1932.993	51	25			1.344	1932.936
12	5.5			1.287	1932.993	52	25.5			1.342	1932.938
13	6			1.287	1932.994	53	26			1.340	1932.940
14	6.5			1.286	1932.994	54	26.5			1.341	1932.939
15	7			1.286	1932.995	55	27			1.343	1932.938
16	7.5			1.285	1932.995	56	27.5			1.343	1932.937
17	8			1.285	1932.996	57	28			1.344	1932.936
18	8.5			1.284	1932.996	58	28.5			1.345	1932.935
19	9			1.283	1932.997	59	29			1.346	1932.934
20	9.5			1.284	1932.996	60	29.5			1.348	1932.933
21	10			1.285	1932.995	61	30			1.349	1932.931
22	10.5			1.285	1932.995	62	30.5			1.351	1932.929
23	11			1.285	1932.995	63	31			1.353	1932.927
24	11.5			1.286	1932.994	64	31.5			1.355	1932.925
25	12			1.286	1932.994	65	32			1.357	1932.923
26	12.5			1.286	1932.994	66	32.5			1.358	1932.922
27	13			1.286	1932.994	67	33			1.359	1932.921
28	13.5			1.291	1932.989	68	33.5			1.362	1932.918
29	14			1.296	1932.985	69	34			1.366	1932.915
30	14.5			1.299	1932.982	70	34.5			1.367	1932.913
31	15			1.302	1932.978	71	35			1.369	1932.911
32	15.5			1.304	1932.976	72	35.5			1.370	1932.910
33	16			1.306	1932.975	73	36			1.371	1932.910
34	16.5			1.307	1932.973	74	36.5			1.372	1932.908
35	17			1.309	1932.971	75	37			1.374	1932.906
36	17.5			1.310	1932.970	76	37.5			1.375	1932.905
37	18			1.311	1932.969	77	38			1.376	1932.904
38	18.5			1.314	1932.966	78	38.5			1.377	1932.903
39	19			1.317	1932.964	79	39			1.378	1932.902
40	19.5			1.319	1932.961	80	39.5			1.378	1932.902

N°	PUNTO	V.AT	AL.INS	V.AD	COTA
81	40			1.379	1932.901
82	40.5			1.340	1932.940
83	41			1.301	1932.979
84	41.5			1.341	1932.939
85	42			1.381	1932.900
86	42.5			1.381	1932.899
87	43			1.382	1932.899
88	43.5			1.380	1932.900
89	44			1.379	1932.901
90	44.5			1.379	1932.902
91	45			1.379	1932.902
92	45.5			1.380	1932.900
93	46			1.381	1932.899
94	46.5			1.382	1932.898
95	47			1.383	1932.897
96	47.5			1.384	1932.896
97	48			1.385	1932.895
98	48.5			1.387	1932.893
99	49			1.389	1932.891
100	49.5			1.388	1932.893
101	50			1.386	1932.894
102	50.5			1.382	1932.899
103	51			1.377	1932.903
104	51.5			1.379	1932.901
105	52			1.382	1932.899
106	52.5			1.383	1932.897
107	53			1.385	1932.895
108	53.5			1.385	1932.896
109	54			1.384	1932.896
110	54.5			1.382	1932.898
111	55			1.380	1932.900
112	55.5			1.381	1932.899
113	56			1.382	1932.898
114	56.5			1.383	1932.898
115	57			1.384	1932.897
116	57.5			1.387	1932.893
117	58	1.38	1934.269	1.391	1932.889
118	58.5			1.380	1932.889
119	59			1.369	1932.900
120	59.5			1.368	1932.901
121	60			1.368	1932.902
122	60.5			1.367	1932.902
123	61			1.366	1932.903
124	61.5			1.367	1932.902
125	62			1.368	1932.902
126	62.5			1.369	1932.900
127	63			1.371	1932.899
128	63.5			1.342	1932.928
129	64			1.313	1932.957
130	64.5			1.343	1932.926

N°	PUNTO	V.AT	AL.INS	V.AD	COTA
131	65			1.374	1932.896
132	65.5			1.374	1932.895
133	66			1.375	1932.895
134	66.5			1.375	1932.894
135	67			1.376	1932.893
136	67.5			1.376	1932.893
137	68			1.377	1932.893
138	68.5			1.376	1932.894
139	69			1.375	1932.894
140	69.5			1.375	1932.895
141	70			1.374	1932.896
142	70.5			1.373	1932.896
143	71			1.373	1932.897
144	71.5			1.372	1932.898
145	72			1.371	1932.899
146	72.5			1.375	1932.895
147	73			1.379	1932.891
148	73.5			1.374	1932.895
149	74			1.370	1932.900
150	74.5			1.369	1932.901
151	75			1.368	1932.902
152	75.5			1.366	1932.904
153	76			1.364	1932.906
154	76.5			1.363	1932.906
155	77			1.362	1932.907
156	77.5			1.363	1932.906
157	78			1.364	1932.906
158	78.5			1.343	1932.927
159	79			1.322	1932.948
160	79.5			1.341	1932.928
161	80			1.361	1932.909
162	80.5			1.360	1932.909
163	81			1.360	1932.910
164	81.5			1.360	1932.909
165	82			1.361	1932.909
166	82.5			1.362	1932.907
167	83			1.364	1932.906
168	83.5			1.365	1932.905
169	84			1.366	1932.904
170	84.5			1.366	1932.904
171	85			1.366	1932.904
172	85.5			1.367	1932.903
173	86			1.367	1932.902
174	86.5			1.365	1932.905
175	87			1.362	1932.907
176	87.5			1.362	1932.908
177	88			1.361	1932.908
178	88.5			1.360	1932.909
179	89			1.360	1932.910
180	89.5			1.359	1932.910

N°	PUNTO	V.AT	AL.INS	V.AD	COTA
181	90			1.358	1932.911
182	90.5			1.359	1932.911
183	91			1.359	1932.910
184	91.5			1.359	1932.910
185	92			1.360	1932.910
186	92.5			1.364	1932.906
187	93			1.368	1932.901
188	93.5			1.365	1932.905
189	94			1.361	1932.908
190	94.5			1.362	1932.907
191	95			1.363	1932.907
192	95.5			1.364	1932.906
193	96			1.365	1932.905
194	96.5			1.365	1932.905
195	97			1.365	1932.905
196	97.5			1.365	1932.904
197	98			1.365	1932.904
198	98.5			1.359	1932.910
199	99			1.353	1932.916
200	99.5			1.347	1932.922
201	100			1.341	1932.928

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Ing. Chambi Gareca Pablo  
**RESPONSABLE DEL LABORATORIA DE  
TOPOGRAFÍA**  
**FACULTAD DE CIENCIAS Y TEGNOLOGÍA**

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Univ. Ramos Quispe Alejandra  
**ESTUDIANTE CIV 502**  
**FACULTAD DE CIENCIAS Y TEGNOLOGÍA**

**Código del tramo:** 02

**Longitud del Tramo:** 100 metros.

**Nombre del tramo:** Av. Felipe Palazón (Rotonda Los Leones - Calle 10)

**Abscisa del tramo inicial:** 0 m.

**Abscisa del tramo final:** 100 m.

**Carril de ida**

**Huella 1**

Nº	PUNTO	V.AT	AL.INS	V.AD	COTA
1	0	1.061	1854.061		1853
2	0.5			1.066	1852.994
3	1			1.072	1852.988
4	1.5			1.078	1852.983
5	2			1.083	1852.977
6	2.5			1.088	1852.973
7	3			1.092	1852.969
8	3.5			1.095	1852.966
9	4			1.098	1852.963
10	4.5			1.100	1852.961
11	5			1.102	1852.958
12	5.5			1.106	1852.955
13	6			1.109	1852.951
14	6.5			1.114	1852.946
15	7			1.119	1852.941
16	7.5			1.122	1852.938
17	8			1.125	1852.935
18	8.5			1.130	1852.931
19	9			1.135	1852.926
20	9.5			1.140	1852.920
21	10			1.146	1852.915
22	10.5			1.150	1852.911
23	11			1.154	1852.907
24	11.5			1.159	1852.902
25	12			1.164	1852.897
26	12.5			1.169	1852.892
27	13			1.174	1852.887
28	13.5			1.177	1852.884
29	14			1.179	1852.881
30	14.5			1.186	1852.874
31	15			1.193	1852.867
32	15.5			1.200	1852.861
33	16			1.206	1852.855
34	16.5			1.214	1852.847
35	17			1.222	1852.838
36	17.5			1.231	1852.830
37	18			1.240	1852.821
38	18.5			1.249	1852.812
39	19			1.258	1852.803
40	19.5			1.267	1852.793

Nº	PUNTO	V.AT	AL.INS	V.AD	COTA
41	20			1.276	1852.784
42	20.5			1.285	1852.775
43	21			1.294	1852.766
44	21.5			1.302	1852.759
45	22			1.309	1852.751
46	22.5			1.319	1852.742
47	23			1.328	1852.732
48	23.5			1.337	1852.724
49	24			1.346	1852.715
50	24.5			1.354	1852.706
51	25			1.363	1852.698
52	25.5			1.370	1852.691
53	26			1.377	1852.683
54	26.5			1.384	1852.677
55	27			1.391	1852.670
56	27.5			1.397	1852.664
57	28			1.403	1852.658
58	28.5			1.409	1852.651
59	29			1.415	1852.645
60	29.5			1.420	1852.640
61	30			1.425	1852.636
62	30.5			1.426	1852.635
63	31			1.426	1852.634
64	31.5			1.430	1852.631
65	32			1.434	1852.627
66	32.5			1.438	1852.623
67	33			1.441	1852.619
68	33.5			1.444	1852.616
69	34			1.447	1852.613
70	34.5			1.451	1852.610
71	35			1.455	1852.606
72	35.5			1.458	1852.603
73	36			1.461	1852.600
74	36.5			1.463	1852.598
75	37			1.465	1852.596
76	37.5			1.468	1852.593
77	38			1.470	1852.590
78	38.5			1.473	1852.587
79	39			1.476	1852.585
80	39.5			1.479	1852.581

N°	PUNTO	V.AT	AL.INS	V.AD	COTA
81	40			1.482	1852.578
82	40.5			1.480	1852.580
83	41			1.478	1852.583
84	41.5			1.479	1852.581
85	42			1.480	1852.580
86	42.5			1.483	1852.577
87	43			1.486	1852.574
88	43.5			1.488	1852.573
89	44			1.489	1852.571
90	44.5			1.492	1852.569
91	45			1.494	1852.567
92	45.5			1.497	1852.564
93	46			1.500	1852.561
94	46.5			1.502	1852.558
95	47			1.505	1852.556
96	47.5			1.509	1852.552
97	48			1.512	1852.548
98	48.5			1.510	1852.550
99	49			1.508	1852.553
100	49.5			1.511	1852.550
101	50			1.513	1852.547
102	50.5			1.517	1852.543
103	51			1.522	1852.539
104	51.5			1.522	1852.539
105	52			1.522	1852.539
106	52.5			1.528	1852.532
107	53			1.535	1852.526
108	53.5			1.537	1852.523
109	54			1.540	1852.521
110	54.5			1.544	1852.517
111	55			1.548	1852.513
112	55.5			1.549	1852.511
113	56			1.550	1852.510
114	56.5			1.552	1852.508
115	57			1.554	1852.507
116	57.5			1.555	1852.506
117	58			1.557	1852.504
118	58.5			1.557	1852.504
119	59			1.557	1852.504
120	59.5			1.561	1852.500
121	60			1.564	1852.496
122	60.5			1.565	1852.496
123	61			1.566	1852.495
124	61.5			1.566	1852.495
125	62			1.566	1852.494
126	62.5			1.567	1852.494
127	63			1.567	1852.493
128	63.5			1.567	1852.494
129	64			1.567	1852.494
130	64.5			1.565	1852.496

N°	PUNTO	V.AT	AL.INS	V.AD	COTA
131	65			1.562	1852.498
132	65.5			1.557	1852.503
133	66			1.552	1852.509
134	66.5			1.551	1852.510
135	67			1.550	1852.511
136	67.5			1.547	1852.513
137	68			1.545	1852.516
138	68.5			1.544	1852.517
139	69			1.542	1852.518
140	69.5			1.541	1852.520
141	70			1.539	1852.521
142	70.5			1.538	1852.523
143	71			1.537	1852.524
144	71.5			1.536	1852.524
145	72			1.536	1852.524
146	72.5			1.538	1852.522
147	73			1.540	1852.520
148	73.5			1.539	1852.521
149	74			1.538	1852.522
150	74.5			1.537	1852.523
151	75			1.536	1852.524
152	75.5			1.536	1852.524
153	76			1.536	1852.524
154	76.5			1.535	1852.525
155	77			1.535	1852.526
156	77.5			1.534	1852.527
157	78			1.533	1852.528
158	78.5			1.532	1852.529
159	79			1.531	1852.530
160	79.5			1.531	1852.529
161	80			1.532	1852.529
162	80.5			1.533	1852.528
163	81			1.535	1852.526
164	81.5			1.535	1852.525
165	82			1.536	1852.525
166	82.5			1.537	1852.523
167	83			1.538	1852.522
168	83.5			1.539	1852.521
169	84			1.540	1852.520
170	84.5			1.543	1852.518
171	85			1.545	1852.515
172	85.5			1.548	1852.513
173	86			1.550	1852.510
174	86.5			1.551	1852.509
175	87			1.553	1852.508
176	87.5			1.555	1852.506
177	88			1.557	1852.503
178	88.5			1.562	1852.499
179	89			1.566	1852.495
180	89.5			1.569	1852.492

N°	PUNTO	V.AT	AL.INS	V.AD	COTA
181	90			1.571	1852.490
182	90.5			1.573	1852.487
183	91			1.575	1852.485
184	91.5			1.579	1852.482
185	92			1.582	1852.479
186	92.5			1.584	1852.476
187	93			1.587	1852.474
188	93.5			1.588	1852.473
189	94			1.589	1852.472
190	94.5			1.589	1852.471
191	95			1.589	1852.471
192	95.5			1.590	1852.471
193	96			1.591	1852.470
194	96.5			1.591	1852.469
195	97			1.592	1852.469
196	97.5			1.590	1852.471
197	98			1.588	1852.472
198	98.5			1.586	1852.475
199	99			1.583	1852.477
200	99.5			1.581	1852.480
201	100			1.579	1852.482

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Ing. Chambi Gareca Pablo

**RESPONSABLE DEL LABORATORIA DE  
TOPOGRAFÍA**

**FACULTAD DE CIENCIAS Y TEGNOLOGÍA**

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Univ. Ramos Quispe Alejandra

**ESTUDIANTE CIV 502**

**FACULTAD DE CIENCIAS Y TEGNOLOGÍA**



**Código del tramo:** 02

**Longitud del Tramo:** 100 metros.

**Nombre del tramo:** Av. Felipe Palazón (Rotonda Los Leones - Calle 10)

**Abscisa del tramo inicial:** 0 m.

**Abscisa del tramo final:** 100 m.

**Carril de ida**

**Huella 2**

Nº	PUNTO	V.AT	AL.INS	V.AD	COTA
1	0	1.043	1855.043		1854
2	0.5			1.048	1853.995
3	1			1.054	1853.989
4	1.5			1.055	1853.988
5	2			1.056	1853.987
6	2.5			1.061	1853.982
7	3			1.066	1853.977
8	3.5			1.069	1853.974
9	4			1.073	1853.970
10	4.5			1.075	1853.968
11	5			1.077	1853.966
12	5.5			1.080	1853.963
13	6			1.082	1853.961
14	6.5			1.087	1853.956
15	7			1.092	1853.951
16	7.5			1.095	1853.948
17	8			1.097	1853.945
18	8.5			1.101	1853.942
19	9			1.105	1853.938
20	9.5			1.108	1853.935
21	10			1.111	1853.932
22	10.5			1.115	1853.928
23	11			1.120	1853.923
24	11.5			1.125	1853.918
25	12			1.131	1853.912
26	12.5			1.135	1853.908
27	13			1.140	1853.903
28	13.5			1.144	1853.899
29	14			1.148	1853.895
30	14.5			1.156	1853.887
31	15			1.163	1853.880
32	15.5			1.169	1853.874
33	16			1.176	1853.867
34	16.5			1.185	1853.858
35	17			1.194	1853.849
36	17.5			1.203	1853.840
37	18			1.211	1853.832
38	18.5			1.220	1853.823
39	19			1.228	1853.815
40	19.5			1.237	1853.806

Nº	PUNTO	V.AT	AL.INS	V.AD	COTA
41	20			1.246	1853.797
42	20.5			1.252	1853.791
43	21			1.259	1853.784
44	21.5			1.268	1853.775
45	22			1.278	1853.765
46	22.5			1.285	1853.758
47	23			1.292	1853.750
48	23.5			1.302	1853.741
49	24			1.311	1853.732
50	24.5			1.317	1853.726
51	25			1.323	1853.720
52	25.5			1.329	1853.714
53	26			1.335	1853.708
54	26.5			1.342	1853.700
55	27			1.350	1853.693
56	27.5			1.357	1853.686
57	28			1.363	1853.680
58	28.5			1.368	1853.675
59	29			1.372	1853.671
60	29.5			1.375	1853.668
61	30			1.378	1853.665
62	30.5			1.381	1853.662
63	31			1.383	1853.659
64	31.5			1.386	1853.657
65	32			1.389	1853.654
66	32.5			1.393	1853.650
67	33			1.397	1853.646
68	33.5			1.401	1853.642
69	34			1.405	1853.638
70	34.5			1.408	1853.635
71	35			1.410	1853.633
72	35.5			1.411	1853.632
73	36			1.413	1853.630
74	36.5			1.415	1853.627
75	37			1.418	1853.625
76	37.5			1.421	1853.622
77	38			1.423	1853.620
78	38.5			1.425	1853.618
79	39			1.427	1853.616
80	39.5			1.429	1853.613

N°	PUNTO	V.AT	AL.INS	V.AD	COTA
81	40			1.432	1853.611
82	40.5			1.434	1853.609
83	41			1.437	1853.606
84	41.5			1.440	1853.603
85	42			1.443	1853.600
86	42.5			1.446	1853.597
87	43			1.449	1853.594
88	43.5			1.451	1853.592
89	44			1.454	1853.589
90	44.5			1.457	1853.586
91	45			1.461	1853.582
92	45.5			1.462	1853.581
93	46			1.464	1853.579
94	46.5			1.468	1853.575
95	47			1.471	1853.572
96	47.5			1.476	1853.567
97	48			1.481	1853.562
98	48.5			1.485	1853.558
99	49			1.489	1853.554
100	49.5			1.490	1853.553
101	50			1.492	1853.551
102	50.5			1.496	1853.547
103	51			1.500	1853.543
104	51.5			1.505	1853.538
105	52			1.509	1853.534
106	52.5			1.512	1853.531
107	53			1.514	1853.529
108	53.5			1.517	1853.526
109	54			1.520	1853.523
110	54.5			1.523	1853.520
111	55			1.526	1853.517
112	55.5			1.529	1853.514
113	56			1.532	1853.511
114	56.5			1.534	1853.508
115	57			1.537	1853.506
116	57.5			1.540	1853.503
117	58			1.543	1853.500
118	58.5			1.545	1853.498
119	59			1.546	1853.497
120	59.5			1.546	1853.496
121	60			1.547	1853.496
122	60.5			1.548	1853.495
123	61			1.549	1853.493
124	61.5			1.550	1853.493
125	62			1.551	1853.492
126	62.5			1.552	1853.491
127	63			1.553	1853.490
128	63.5			1.553	1853.489
129	64			1.554	1853.489
130	64.5			1.551	1853.492

N°	PUNTO	V.AT	AL.INS	V.AD	COTA
131	65			1.548	1853.495
132	65.5			1.548	1853.495
133	66			1.548	1853.494
134	66.5			1.547	1853.496
135	67			1.546	1853.497
136	67.5			1.544	1853.499
137	68			1.542	1853.501
138	68.5			1.540	1853.503
139	69			1.539	1853.504
140	69.5			1.537	1853.506
141	70			1.535	1853.508
142	70.5			1.537	1853.506
143	71			1.539	1853.504
144	71.5			1.536	1853.507
145	72			1.534	1853.509
146	72.5			1.532	1853.511
147	73			1.531	1853.512
148	73.5			1.529	1853.514
149	74			1.528	1853.515
150	74.5			1.527	1853.516
151	75			1.525	1853.518
152	75.5			1.524	1853.519
153	76			1.523	1853.520
154	76.5			1.522	1853.521
155	77			1.520	1853.523
156	77.5			1.518	1853.525
157	78			1.516	1853.527
158	78.5			1.516	1853.526
159	79			1.516	1853.526
160	79.5			1.517	1853.526
161	80			1.517	1853.526
162	80.5			1.517	1853.526
163	81			1.517	1853.526
164	81.5			1.517	1853.526
165	82			1.517	1853.525
166	82.5			1.519	1853.524
167	83			1.520	1853.523
168	83.5			1.522	1853.521
169	84			1.523	1853.520
170	84.5			1.526	1853.517
171	85			1.528	1853.514
172	85.5			1.532	1853.511
173	86			1.535	1853.508
174	86.5			1.536	1853.507
175	87			1.537	1853.506
176	87.5			1.540	1853.503
177	88			1.542	1853.501
178	88.5			1.546	1853.497
179	89			1.550	1853.493
180	89.5			1.552	1853.491

N°	PUNTO	V.AT	AL.INS	V.AD	COTA
181	90			1.554	1853.489
182	90.5			1.556	1853.487
183	91			1.559	1853.484
184	91.5			1.560	1853.482
185	92			1.562	1853.481
186	92.5			1.563	1853.479
187	93			1.565	1853.478
188	93.5			1.568	1853.475
189	94			1.570	1853.473
190	94.5			1.571	1853.472
191	95			1.571	1853.472
192	95.5			1.573	1853.470
193	96			1.574	1853.469
194	96.5			1.573	1853.470
195	97			1.571	1853.472
196	97.5			1.571	1853.472
197	98			1.571	1853.472
198	98.5			1.569	1853.474
199	99			1.566	1853.477
200	99.5			1.563	1853.480
201	100			1.561	1853.482

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Ing. Chambi Gareca Pablo

**RESPONSABLE DEL LABORATORIA DE  
TOPOGRAFÍA**

**FACULTAD DE CIENCIAS Y TEGNOLOGÍA**

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Univ. Ramos Quispe Alejandra

**ESTUDIANTE CIV 502**

**FACULTAD DE CIENCIAS Y TEGNOLOGÍA**

**Código del tramo:** 02

**Longitud del Tramo:** 100 metros.

**Nombre del tramo:** Av. Felipe Palazón (Rotonda Los Leones - Calle 10)

**Abscisa del tramo inicial:** 0 m.

**Abscisa del tramo final:** 100 m.

**Carril de vuelta**

**Huella 1**

Nº	PUNTO	V.AT	AL.INS	V.AD	COTA	Nº	PUNTO	V.AT	AL.INS	V.AD	COTA
1	0	1.066	1868.066		1867	41	20			1.277	1866.789
2	0.5			1.069	1866.997	42	20.5			1.286	1866.780
3	1			1.073	1866.994	43	21			1.295	1866.771
4	1.5			1.078	1866.988	44	21.5			1.302	1866.764
5	2			1.084	1866.983	45	22			1.310	1866.756
6	2.5			1.088	1866.978	46	22.5			1.319	1866.747
7	3			1.092	1866.974	47	23			1.328	1866.738
8	3.5			1.095	1866.971	48	23.5			1.338	1866.728
9	4			1.098	1866.968	49	24			1.346	1866.720
10	4.5			1.100	1866.966	50	24.5			1.354	1866.712
11	5			1.103	1866.963	51	25			1.363	1866.703
12	5.5			1.106	1866.960	52	25.5			1.370	1866.696
13	6			1.110	1866.957	53	26			1.378	1866.688
14	6.5			1.114	1866.952	54	26.5			1.384	1866.682
15	7			1.119	1866.947	55	27			1.391	1866.675
16	7.5			1.123	1866.944	56	27.5			1.397	1866.669
17	8			1.126	1866.940	57	28			1.403	1866.663
18	8.5			1.130	1866.936	58	28.5			1.409	1866.657
19	9			1.135	1866.931	59	29			1.416	1866.650
20	9.5			1.140	1866.926	60	29.5			1.420	1866.646
21	10			1.146	1866.920	61	30			1.425	1866.641
22	10.5			1.150	1866.916	62	30.5			1.426	1866.640
23	11			1.154	1866.912	63	31			1.427	1866.640
24	11.5			1.159	1866.907	64	31.5			1.430	1866.636
25	12			1.164	1866.902	65	32			1.434	1866.632
26	12.5			1.169	1866.897	66	32.5			1.438	1866.628
27	13			1.174	1866.892	67	33			1.442	1866.624
28	13.5			1.177	1866.889	68	33.5			1.444	1866.622
29	14			1.180	1866.886	69	34			1.447	1866.619
30	14.5			1.187	1866.879	70	34.5			1.451	1866.615
31	15			1.194	1866.872	71	35			1.455	1866.611
32	15.5			1.200	1866.866	72	35.5			1.458	1866.608
33	16			1.206	1866.860	73	36			1.461	1866.605
34	16.5			1.214	1866.852	74	36.5			1.463	1866.603
35	17			1.223	1866.843	75	37			1.465	1866.601
36	17.5			1.231	1866.835	76	37.5			1.468	1866.598
37	18			1.240	1866.826	77	38			1.471	1866.595
38	18.5			1.249	1866.817	78	38.5			1.473	1866.593
39	19			1.258	1866.808	79	39			1.476	1866.590
40	19.5			1.267	1866.799	80	39.5			1.479	1866.587

N°	PUNTO	V.AT	AL.INS	V.AD	COTA
81	40			1.483	1866.583
82	40.5			1.481	1866.585
83	41			1.479	1866.588
84	41.5			1.479	1866.587
85	42			1.480	1866.586
86	42.5			1.483	1866.583
87	43			1.486	1866.580
88	43.5			1.488	1866.578
89	44			1.489	1866.577
90	44.5			1.492	1866.574
91	45			1.494	1866.572
92	45.5			1.497	1866.569
93	46			1.500	1866.566
94	46.5			1.502	1866.564
95	47			1.505	1866.561
96	47.5			1.509	1866.557
97	48			1.513	1866.553
98	48.5			1.511	1866.555
99	49			1.509	1866.557
100	49.5			1.511	1866.555
101	50			1.513	1866.553
102	50.5			1.518	1866.548
103	51			1.522	1866.544
104	51.5			1.522	1866.544
105	52			1.522	1866.544
106	52.5			1.529	1866.537
107	53			1.535	1866.531
108	53.5			1.540	1866.526
109	54			1.545	1866.521
110	54.5			1.547	1866.519
111	55			1.548	1866.518
112	55.5			1.550	1866.517
113	56			1.551	1866.515
114	56.5			1.553	1866.514
115	57			1.554	1866.512
116	57.5			1.556	1866.510
117	58			1.558	1866.508
118	58.5			1.558	1866.508
119	59			1.557	1866.509
120	59.5			1.561	1866.505
121	60			1.565	1866.501
122	60.5			1.565	1866.501
123	61			1.566	1866.500
124	61.5			1.566	1866.500
125	62			1.566	1866.500
126	62.5			1.567	1866.499
127	63			1.568	1866.498
128	63.5			1.567	1866.499
129	64			1.567	1866.499
130	64.5			1.565	1866.501

N°	PUNTO	V.AT	AL.INS	V.AD	COTA
131	65			1.563	1866.503
132	65.5			1.557	1866.509
133	66			1.552	1866.514
134	66.5			1.551	1866.515
135	67			1.550	1866.516
136	67.5			1.548	1866.518
137	68			1.546	1866.520
138	68.5			1.544	1866.522
139	69			1.543	1866.524
140	69.5			1.541	1866.525
141	70			1.540	1866.527
142	70.5			1.538	1866.528
143	71			1.537	1866.529
144	71.5			1.537	1866.529
145	72			1.536	1866.530
146	72.5			1.538	1866.528
147	73			1.541	1866.526
148	73.5			1.540	1866.526
149	74			1.539	1866.527
150	74.5			1.538	1866.529
151	75			1.536	1866.530
152	75.5			1.536	1866.530
153	76			1.536	1866.530
154	76.5			1.536	1866.530
155	77			1.535	1866.531
156	77.5			1.534	1866.532
157	78			1.534	1866.532
158	78.5			1.532	1866.534
159	79			1.531	1866.535
160	79.5			1.531	1866.535
161	80			1.532	1866.534
162	80.5			1.533	1866.533
163	81			1.535	1866.531
164	81.5			1.535	1866.531
165	82			1.536	1866.530
166	82.5			1.537	1866.529
167	83			1.539	1866.527
168	83.5			1.540	1866.526
169	84			1.541	1866.525
170	84.5			1.543	1866.523
171	85			1.546	1866.520
172	85.5			1.548	1866.518
173	86			1.551	1866.515
174	86.5			1.552	1866.514
175	87			1.553	1866.513
176	87.5			1.555	1866.511
177	88			1.558	1866.508
178	88.5			1.563	1866.503
179	89			1.569	1866.497
180	89.5			1.570	1866.496

N°	PUNTO	V.AT	AL.INS	V.AD	COTA
181	90			1.571	1866.495
182	90.5			1.573	1866.493
183	91			1.576	1866.491
184	91.5			1.579	1866.487
185	92			1.582	1866.484
186	92.5			1.585	1866.482
187	93			1.587	1866.479
188	93.5			1.588	1866.478
189	94			1.590	1866.477
190	94.5			1.590	1866.477
191	95			1.590	1866.477
192	95.5			1.590	1866.476
193	96			1.591	1866.475
194	96.5			1.591	1866.475
195	97			1.592	1866.474
196	97.5			1.590	1866.476
197	98			1.589	1866.477
198	98.5			1.586	1866.480
199	99			1.584	1866.482
200	99.5			1.581	1866.485
201	100			1.579	1866.487

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Ing. Chambi Gareca Pablo

**RESPONSABLE DEL LABORATORIA DE  
TOPOGRAFÍA**

**FACULTAD DE CIENCIAS Y TEGNOLOGÍA**

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Univ. Ramos Quispe Alejandra

**ESTUDIANTE CIV 502**

**FACULTAD DE CIENCIAS Y TEGNOLOGÍA**

**Código del tramo:** 02

**Longitud del Tramo:** 100 metros.

**Nombre del tramo:** Av. Felipe Palazón (Rotonda Los Leones - Calle 10)

**Abscisa del tramo inicial:** 0 m.

**Abscisa del tramo final:** 100 m.

**Carril de vuelta**

**Huella 2**

Nº	PUNTO	V.AT	AL.INS	V.AD	COTA
1	0	1.044	1869.044		1868
2	0.5			1.049	1867.995
3	1			1.054	1867.990
4	1.5			1.056	1867.988
5	2			1.059	1867.985
6	2.5			1.062	1867.982
7	3			1.066	1867.978
8	3.5			1.069	1867.975
9	4			1.073	1867.971
10	4.5			1.075	1867.969
11	5			1.078	1867.967
12	5.5			1.080	1867.964
13	6			1.083	1867.961
14	6.5			1.087	1867.957
15	7			1.092	1867.952
16	7.5			1.095	1867.949
17	8			1.098	1867.946
18	8.5			1.101	1867.943
19	9			1.105	1867.939
20	9.5			1.108	1867.936
21	10			1.111	1867.933
22	10.5			1.115	1867.929
23	11			1.120	1867.924
24	11.5			1.125	1867.919
25	12			1.131	1867.913
26	12.5			1.136	1867.909
27	13			1.140	1867.904
28	13.5			1.144	1867.900
29	14			1.148	1867.896
30	14.5			1.157	1867.887
31	15			1.165	1867.879
32	15.5			1.170	1867.874
33	16			1.176	1867.868
34	16.5			1.186	1867.858
35	17			1.197	1867.847
36	17.5			1.204	1867.840
37	18			1.212	1867.832
38	18.5			1.220	1867.824
39	19			1.228	1867.816
40	19.5			1.237	1867.807

Nº	PUNTO	V.AT	AL.INS	V.AD	COTA
41	20			1.246	1867.798
42	20.5			1.253	1867.792
43	21			1.259	1867.785
44	21.5			1.268	1867.776
45	22			1.278	1867.766
46	22.5			1.285	1867.759
47	23			1.293	1867.751
48	23.5			1.302	1867.742
49	24			1.311	1867.733
50	24.5			1.317	1867.727
51	25			1.323	1867.721
52	25.5			1.329	1867.715
53	26			1.335	1867.709
54	26.5			1.343	1867.701
55	27			1.351	1867.693
56	27.5			1.357	1867.687
57	28			1.363	1867.681
58	28.5			1.368	1867.676
59	29			1.373	1867.672
60	29.5			1.375	1867.669
61	30			1.378	1867.666
62	30.5			1.381	1867.663
63	31			1.384	1867.660
64	31.5			1.387	1867.657
65	32			1.390	1867.655
66	32.5			1.393	1867.651
67	33			1.397	1867.647
68	33.5			1.401	1867.643
69	34			1.406	1867.639
70	34.5			1.408	1867.636
71	35			1.410	1867.634
72	35.5			1.412	1867.632
73	36			1.413	1867.631
74	36.5			1.416	1867.628
75	37			1.418	1867.626
76	37.5			1.421	1867.623
77	38			1.423	1867.621
78	38.5			1.425	1867.619
79	39			1.428	1867.617
80	39.5			1.430	1867.614

N°	PUNTO	V.AT	AL.INS	V.AD	COTA
81	40			1.432	1867.612
82	40.5			1.435	1867.609
83	41			1.438	1867.606
84	41.5			1.441	1867.603
85	42			1.443	1867.601
86	42.5			1.446	1867.598
87	43			1.449	1867.595
88	43.5			1.451	1867.593
89	44			1.454	1867.590
90	44.5			1.457	1867.587
91	45			1.461	1867.583
92	45.5			1.463	1867.582
93	46			1.464	1867.580
94	46.5			1.468	1867.576
95	47			1.472	1867.573
96	47.5			1.476	1867.568
97	48			1.481	1867.563
98	48.5			1.485	1867.559
99	49			1.489	1867.555
100	49.5			1.490	1867.554
101	50			1.492	1867.552
102	50.5			1.496	1867.548
103	51			1.501	1867.543
104	51.5			1.506	1867.538
105	52			1.511	1867.533
106	52.5			1.513	1867.531
107	53			1.514	1867.530
108	53.5			1.517	1867.527
109	54			1.520	1867.524
110	54.5			1.523	1867.521
111	55			1.526	1867.518
112	55.5			1.529	1867.515
113	56			1.532	1867.512
114	56.5			1.535	1867.509
115	57			1.537	1867.507
116	57.5			1.540	1867.504
117	58			1.544	1867.501
118	58.5			1.545	1867.499
119	59			1.546	1867.498
120	59.5			1.547	1867.497
121	60			1.548	1867.497
122	60.5			1.549	1867.495
123	61			1.550	1867.494
124	61.5			1.550	1867.494
125	62			1.551	1867.493
126	62.5			1.552	1867.492
127	63			1.554	1867.490
128	63.5			1.554	1867.490
129	64			1.554	1867.490
130	64.5			1.551	1867.493

N°	PUNTO	V.AT	AL.INS	V.AD	COTA
131	65			1.548	1867.496
132	65.5			1.548	1867.496
133	66			1.549	1867.495
134	66.5			1.549	1867.495
135	67			1.548	1867.496
136	67.5			1.545	1867.499
137	68			1.542	1867.502
138	68.5			1.541	1867.503
139	69			1.539	1867.505
140	69.5			1.537	1867.507
141	70			1.535	1867.509
142	70.5			1.537	1867.507
143	71			1.539	1867.505
144	71.5			1.537	1867.508
145	72			1.534	1867.510
146	72.5			1.532	1867.512
147	73			1.531	1867.513
148	73.5			1.530	1867.514
149	74			1.528	1867.516
150	74.5			1.528	1867.516
151	75			1.527	1867.517
152	75.5			1.526	1867.519
153	76			1.524	1867.520
154	76.5			1.522	1867.522
155	77			1.520	1867.524
156	77.5			1.518	1867.526
157	78			1.517	1867.528
158	78.5			1.517	1867.527
159	79			1.517	1867.527
160	79.5			1.518	1867.526
161	80			1.519	1867.525
162	80.5			1.518	1867.526
163	81			1.517	1867.527
164	81.5			1.517	1867.527
165	82			1.518	1867.527
166	82.5			1.534	1867.510
167	83			1.550	1867.494
168	83.5			1.537	1867.507
169	84			1.523	1867.521
170	84.5			1.526	1867.518
171	85			1.529	1867.515
172	85.5			1.532	1867.512
173	86			1.535	1867.509
174	86.5			1.537	1867.507
175	87			1.539	1867.505
176	87.5			1.543	1867.502
177	88			1.546	1867.498
178	88.5			1.548	1867.496
179	89			1.550	1867.494
180	89.5			1.552	1867.492



N°	PUNTO	V.AT	AL.INS	V.AD	COTA
181	90			1.554	1867.490
182	90.5			1.556	1867.488
183	91			1.559	1867.485
184	91.5			1.561	1867.483
185	92			1.562	1867.482
186	92.5			1.564	1867.480
187	93			1.565	1867.479
188	93.5			1.568	1867.476
189	94			1.571	1867.473
190	94.5			1.571	1867.473
191	95			1.571	1867.473
192	95.5			1.573	1867.471
193	96			1.575	1867.470
194	96.5			1.573	1867.471
195	97			1.571	1867.473
196	97.5			1.572	1867.472
197	98			1.573	1867.471
198	98.5			1.571	1867.473
199	99			1.569	1867.475
200	99.5			1.565	1867.479
201	100			1.561	1867.483

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**RESULTADOS OBTENIDOS:**

<b>TRAMO URBANO</b>	<b>IRI NIVEL DE INGENIERO (m/km)</b>	
	<b>CARRIL DE IDA</b>	
	HUELLA 1	HUELLA 2
Av. Jesús Molina (Cruce ruta San Jacinto - Casa del Mariachi)	3.337	2.225
Av. Felipe Palazón (Rotonda Los Leones - Calle 10)	4.112	4.198

<b>TRAMO URBANO</b>	<b>IRI NIVEL DE INGENIERO (m/km)</b>	
	<b>CARRIL DE VUELTA</b>	
	HUELLA 1	HUELLA 2
Av. Jesús Molina (Cruce ruta San Jacinto - Casa del Mariachi)	3.065	2.539
Av. Felipe Palazón (Rotonda Los Leones - Calle 10)	4.759	3.241

<b>TRAMOS URBANA</b>	<b>MEDIA MIRA Y NIVEL</b>	
	IDA	VUELTA
Av. Jesús Molina (Cruce ruta San Jacinto - Casa del Mariachi)	2.78	2.80
Av. Felipe Palazón (Rotonda Los Leones - Calle 10)	4.16	4.00



## **ANEXO B**

### **DATOS TOPOGRAFICOS PARA LA OBTENCIÓN DEL IRI ZONA RURAL MÉTODO TRADICIONAL DE MEDICIÓN DEL IRI (MIRA Y NIVEL DE INGENIERO)**

## DATOS TOPOGRÁFICOS DE CAMPO PARA EL CÁLCULO DEL IRI

**Código del tramo:** 03

**Longitud del Tramo:** 100 metros.

**Nombre del tramo:** El Portillo -La Pintada (Cruce Ruta 11 Villamontes - Entrada al proyecto múltiples san jacinto - oficinas)

**Abscisa del tramo inicial:** 0 m.

**Abscisa del tramo final:** 100 m.

**Carril de ida**

**Huella 1**

N°	PUNTO	V.AT	AL.INS	V.AD	COTA
1	0	0.672	1877.672		1877.000
2	0.5			0.674	1876.998
3	1			0.675	1876.997
4	1.5			0.683	1876.989
5	2			0.690	1876.982
6	2.5			0.694	1876.978
7	3			0.702	1876.970
8	3.5			0.709	1876.963
9	4			0.714	1876.958
10	4.5			0.721	1876.951
11	5			0.725	1876.947
12	5.5			0.730	1876.942
13	6			0.737	1876.935
14	6.5			0.743	1876.929
15	7			0.746	1876.926
16	7.5			0.752	1876.920
17	8			0.756	1876.916
18	8.5			0.761	1876.911
19	9			0.764	1876.908
20	9.5			0.769	1876.903
21	10			0.775	1876.897
22	10.5			0.780	1876.892
23	11			0.785	1876.887
24	11.5			0.788	1876.884
25	12			0.792	1876.880
26	12.5			0.796	1876.876
27	13			0.803	1876.869
28	13.5			0.808	1876.864
29	14			0.814	1876.858
30	14.5			0.819	1876.853
31	15			0.824	1876.848
32	15.5			0.828	1876.844
33	16			0.833	1876.839
34	16.5			0.839	1876.833
35	17			0.844	1876.828
36	17.5			0.848	1876.824
37	18			0.855	1876.817
38	18.5			0.862	1876.810
39	19			0.868	1876.804
40	19.5			0.871	1876.801

N°	PUNTO	V.AT	AL.INS	V.AD	COTA
41	20			0.879	1876.793
42	20.5			0.884	1876.788
43	21			0.890	1876.782
44	21.5			0.895	1876.777
45	22			0.901	1876.771
46	22.5			0.007	1877.665
47	23			0.916	1876.756
48	23.5			0.920	1876.751
49	24			0.927	1876.745
50	24.5			0.934	1876.738
51	25			0.938	1876.733
52	25.5			0.946	1876.726
53	26			0.951	1876.721
54	26.5			0.959	1876.713
55	27			0.964	1876.708
56	27.5			0.972	1876.700
57	28			0.978	1876.694
58	28.5			0.985	1876.687
59	29			0.992	1876.680
60	29.5			0.999	1876.673
61	30			1.006	1876.666
62	30.5			1.011	1876.661
63	31			1.017	1876.655
64	31.5			1.023	1876.649
65	32			1.031	1876.641
66	32.5			1.034	1876.638
67	33			1.040	1876.632
68	33.5			1.047	1876.625
69	34			1.051	1876.621
70	34.5			1.057	1876.615
71	35			1.065	1876.607
72	35.5			1.072	1876.600
73	36			1.078	1876.594
74	36.5			1.083	1876.589
75	37			1.088	1876.584
76	37.5			1.094	1876.578
77	38			1.102	1876.570
78	38.5			1.106	1876.566
79	39			1.114	1876.558
80	39.5			1.125	1876.547

N°	PUNTO	V.AT	AL.INS	V.AD	COTA
81	40			1.139	1876.533
82	40.5			1.146	1876.526
83	41			1.158	1876.514
84	41.5			1.163	1876.509
85	42			1.176	1876.496
86	42.5			1.191	1876.481
87	43			1.201	1876.471
88	43.5			1.214	1876.458
89	44			1.223	1876.449
90	44.5			1.237	1876.435
91	45			1.244	1876.428
92	45.5			1.257	1876.415
93	46			1.266	1876.406
94	46.5			1.276	1876.396
95	47			1.284	1876.388
96	47.5			1.294	1876.378
97	48			1.303	1876.369
98	48.5			1.312	1876.360
99	49			1.321	1876.351
100	49.5			1.332	1876.340
101	50			1.340	1876.332
102	50.5			1.352	1876.320
103	51			1.364	1876.308
104	51.5			1.371	1876.301
105	52			1.380	1876.292
106	52.5			1.387	1876.285
107	53			1.399	1876.273
108	53.5			1.408	1876.264
109	54			1.416	1876.256
110	54.5			1.427	1876.245
111	55			1.438	1876.233
112	55.5			1.451	1876.221
113	56			1.462	1876.210
114	56.5			1.469	1876.203
115	57			1.480	1876.192
116	57.5			1.486	1876.186
117	58			1.497	1876.175
118	58.5			1.511	1876.161
119	59			1.520	1876.152
120	59.5			1.528	1876.144
121	60			1.532	1876.140
122	60.5			1.540	1876.132
123	61			1.548	1876.124
124	61.5			1.560	1876.112
125	62			1.569	1876.103
126	62.5			1.582	1876.090
127	63			1.592	1876.080
128	63.5			1.602	1876.070
129	64			1.607	1876.065
130	64.5			1.620	1876.051

N°	PUNTO	V.AT	AL.INS	V.AD	COTA
131	65			1.630	1876.042
132	65.5			1.641	1876.031
133	66			1.652	1876.020
134	66.5			1.662	1876.010
135	67			1.675	1875.997
136	67.5			1.686	1875.986
137	68			1.700	1875.972
138	68.5			1.711	1875.961
139	69			1.722	1875.950
140	69.5			1.733	1875.939
141	70			1.746	1875.926
142	70.5			1.756	1875.916
143	71			1.771	1875.901
144	71.5			1.782	1875.890
145	72			1.796	1875.875
146	72.5			1.807	1875.865
147	73			1.814	1875.857
148	73.5			1.826	1875.845
149	74			1.839	1875.833
150	74.5			1.853	1875.819
151	75			1.866	1875.806
152	75.5			1.878	1875.794
153	76			1.890	1875.782
154	76.5			1.902	1875.769
155	77			1.913	1875.759
156	77.5			1.926	1875.746
157	78			1.942	1875.730
158	78.5			1.954	1875.718
159	79			1.964	1875.708
160	79.5			1.975	1875.697
161	80			1.982	1875.690
162	80.5			1.994	1875.678
163	81			2.010	1875.662
164	81.5			2.018	1875.654
165	82			2.030	1875.642
166	82.5			2.042	1875.630
167	83			2.054	1875.618
168	83.5			2.065	1875.606
169	84			2.076	1875.596
170	84.5			2.089	1875.583
171	85			2.096	1875.576
172	85.5			2.107	1875.565
173	86			2.118	1875.554
174	86.5			2.135	1875.537
175	87			2.145	1875.527
176	87.5			2.154	1875.518
177	88			2.163	1875.509
178	88.5			2.172	1875.500
179	89			2.180	1875.492
180	89.5			2.193	1875.479

N°	PUNTO	V.AT	AL.INS	V.AD	COTA
181	90			2.203	1875.469
182	90.5			2.214	1875.458
183	91			2.227	1875.445
184	91.5			2.242	1875.430
185	92			2.255	1875.417
186	92.5			2.264	1875.408
187	93			2.278	1875.394
188	93.5			2.286	1875.386
189	94			2.296	1875.376
190	94.5			2.305	1875.366
191	95			2.316	1875.356
192	95.5			2.336	1875.336
193	96			2.337	1875.335
194	96.5			2.351	1875.321
195	97			2.365	1875.307
196	97.5			2.373	1875.299
197	98			2.382	1875.290
198	98.5			2.392	1875.279
199	99			2.404	1875.268
200	99.5			2.412	1875.260
201	100			2.414	1875.258

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**ESTUDIANTE CIV 502**  
**FACULTAD DE CIENCIAS Y TEGNOLOGÍA**

**Código del tramo: 03**

**Longitud del Tramo: 100 metros.**

**Nombre del tramo: El Portillo -La Pintada (Cruce Ruta 11 Villamontes - Entrada al proyecto múltiples san jacinto - oficinas)**

**Abscisa del tramo inicial: 0 m.**

**Abscisa del tramo final: 100 m.**

**Carril de ida**

**Huella 2**

N°	PUNTO	V.AT	AL.INS	V.AD	COTA	N°	PUNTO	V.AT	AL.INS	V.AD	COTA
1	0	0.636	1878.636		1878.000	41	20			0.827	1877.809
2	0.5			0.637	1877.999	42	20.5			0.832	1877.804
3	1			0.641	1877.995	43	21			0.838	1877.797
4	1.5			0.648	1877.988	44	21.5			0.843	1877.793
5	2			0.655	1877.981	45	22			0.852	1877.784
6	2.5			0.661	1877.975	46	22.5			0.859	1877.777
7	3			0.666	1877.970	47	23			0.865	1877.771
8	3.5			0.671	1877.965	48	23.5			0.872	1877.764
9	4			0.677	1877.959	49	24			0.879	1877.757
10	4.5			0.680	1877.955	50	24.5			0.886	1877.750
11	5			0.683	1877.953	51	25			0.895	1877.741
12	5.5			0.688	1877.948	52	25.5			0.901	1877.735
13	6			0.691	1877.945	53	26			0.908	1877.728
14	6.5			0.697	1877.939	54	26.5			0.915	1877.721
15	7			0.700	1877.936	55	27			0.920	1877.716
16	7.5			0.704	1877.932	56	27.5			0.926	1877.710
17	8			0.708	1877.928	57	28			0.934	1877.702
18	8.5			0.711	1877.925	58	28.5			0.942	1877.694
19	9			0.715	1877.921	59	29			0.949	1877.686
20	9.5			0.720	1877.916	60	29.5			0.956	1877.680
21	10			0.725	1877.911	61	30			0.964	1877.672
22	10.5			0.729	1877.907	62	30.5			0.971	1877.665
23	11			0.734	1877.902	63	31			0.976	1877.659
24	11.5			0.737	1877.899	64	31.5			0.986	1877.650
25	12			0.743	1877.893	65	32			0.991	1877.644
26	12.5			0.746	1877.890	66	32.5			0.996	1877.639
27	13			0.751	1877.885	67	33			1.005	1877.631
28	13.5			0.757	1877.879	68	33.5			1.009	1877.627
29	14			0.760	1877.876	69	34			1.017	1877.619
30	14.5			0.766	1877.870	70	34.5			1.023	1877.613
31	15			0.771	1877.865	71	35			1.034	1877.602
32	15.5			0.776	1877.860	72	35.5			1.041	1877.595
33	16			0.781	1877.855	73	36			1.049	1877.587
34	16.5			0.787	1877.849	74	36.5			1.057	1877.579
35	17			0.791	1877.845	75	37			1.064	1877.572
36	17.5			0.791	1877.845	76	37.5			1.072	1877.564
37	18			0.804	1877.832	77	38			1.080	1877.556
38	18.5			0.811	1877.825	78	38.5			1.086	1877.550
39	19			0.815	1877.821	79	39			1.090	1877.546
40	19.5			0.821	1877.815	80	39.5			1.099	1877.537



N°	PUNTO	V.AT	AL.INS	V.AD	COTA
81	40			1.107	1877.529
82	40.5			1.118	1877.518
83	41			1.124	1877.512
84	41.5			1.133	1877.502
85	42			1.144	1877.492
86	42.5			1.150	1877.486
87	43			1.158	1877.478
88	43.5			1.170	1877.466
89	44			1.178	1877.458
90	44.5			1.189	1877.447
91	45			1.196	1877.440
92	45.5			1.206	1877.430
93	46			1.219	1877.417
94	46.5			1.234	1877.402
95	47			1.242	1877.394
96	47.5			1.250	1877.386
97	48			1.258	1877.378
98	48.5			1.265	1877.371
99	49			1.269	1877.366
100	49.5			1.278	1877.358
101	50			1.289	1877.347
102	50.5			1.304	1877.332
103	51			1.312	1877.324
104	51.5			1.324	1877.312
105	52			1.330	1877.306
106	52.5			1.336	1877.300
107	53			1.343	1877.293
108	53.5			1.354	1877.282
109	54			1.365	1877.271
110	54.5			1.375	1877.261
111	55			1.385	1877.251
112	55.5			1.395	1877.240
113	56			1.405	1877.231
114	56.5			1.415	1877.221
115	57			1.428	1877.208
116	57.5			1.441	1877.195
117	58			1.450	1877.186
118	58.5			1.459	1877.177
119	59			1.470	1877.166
120	59.5			1.479	1877.157
121	60			1.486	1877.150
122	60.5			1.494	1877.142
123	61			1.501	1877.135
124	61.5			1.517	1877.119
125	62			1.530	1877.106
126	62.5			1.538	1877.098
127	63			1.548	1877.088
128	63.5			1.555	1877.081
129	64			1.566	1877.070
130	64.5			1.577	1877.059

N°	PUNTO	V.AT	AL.INS	V.AD	COTA
131	65			1.588	1877.048
132	65.5			1.598	1877.038
133	66			1.612	1877.024
134	66.5			1.621	1877.015
135	67			1.630	1877.006
136	67.5			1.641	1876.995
137	68			1.652	1876.984
138	68.5			1.661	1876.975
139	69			1.671	1876.965
140	69.5			1.682	1876.954
141	70			1.687	1876.949
142	70.5			1.696	1876.940
143	71			1.707	1876.929
144	71.5			1.718	1876.918
145	72			1.730	1876.906
146	72.5			1.740	1876.896
147	73			1.755	1876.881
148	73.5			1.777	1876.859
149	74			1.779	1876.856
150	74.5			1.789	1876.847
151	75			1.807	1876.829
152	75.5			1.818	1876.818
153	76			1.832	1876.804
154	76.5			1.844	1876.792
155	77			1.857	1876.779
156	77.5			1.868	1876.768
157	78			1.882	1876.754
158	78.5			1.896	1876.740
159	79			1.907	1876.729
160	79.5			1.916	1876.720
161	80			1.929	1876.707
162	80.5			1.939	1876.697
163	81			1.951	1876.685
164	81.5			1.959	1876.676
165	82			1.970	1876.666
166	82.5			1.983	1876.653
167	83			1.993	1876.643
168	83.5			2.005	1876.631
169	84			2.011	1876.625
170	84.5			2.026	1876.610
171	85			2.037	1876.599
172	85.5			2.051	1876.585
173	86			2.064	1876.572
174	86.5			2.072	1876.564
175	87			2.086	1876.550
176	87.5			2.092	1876.544
177	88			2.106	1876.530
178	88.5			2.119	1876.517
179	89			2.130	1876.506
180	89.5			2.139	1876.497

N°	PUNTO	V.AT	AL.INS	V.AD	COTA
181	90			2.153	1876.482
182	90.5			2.164	1876.472
183	91			2.176	1876.460
184	91.5			2.190	1876.446
185	92			2.201	1876.435
186	92.5			2.215	1876.421
187	93			2.234	1876.402
188	93.5			2.245	1876.391
189	94			2.254	1876.382
190	94.5			2.265	1876.371
191	95			2.274	1876.362
192	95.5			2.287	1876.349
193	96			2.299	1876.337
194	96.5			2.311	1876.325
195	97			2.325	1876.311
196	97.5			2.337	1876.299
197	98			2.348	1876.288
198	98.5			2.357	1876.279
199	99			2.368	1876.268
200	99.5			2.380	1876.256
201	100			2.393	1876.243

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Ing. Chambi Gareca Pablo  
**RESPONSABLE DEL LABORATORIA DE  
TOPOGRAFÍA**  
**FACULTAD DE CIENCIAS Y TEGNOLOGÍA**

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Univ. Ramos Quispe Alejandra  
**ESTUDIANTE CIV 502**  
**FACULTAD DE CIENCIAS Y TEGNOLOGÍA**

**Código del tramo:** 03

**Longitud del Tramo:** 100 metros.

**Nombre del tramo:** El Portillo -La Pintada (Cruce Ruta 11 Villamontes - Entrada al proyecto múltiples san jacinto - oficinas)

**Abscisa del tramo inicial:** 0 m.

**Abscisa del tramo final:** 100 m.

**Carril de vuelta**

**Huella 1**

N°	PUNTO	V.AT	AL.INS	V.AD	COTA
1	0	0.672	1886.672		1886.000
2	0.5			0.673	1885.998
3	1			0.675	1885.997
4	1.5			0.683	1885.989
5	2			0.690	1885.982
6	2.5			0.698	1885.974
7	3			0.705	1885.967
8	3.5			0.711	1885.961
9	4			0.717	1885.955
10	4.5			0.721	1885.951
11	5			0.725	1885.947
12	5.5			0.731	1885.941
13	6			0.737	1885.935
14	6.5			0.742	1885.930
15	7			0.747	1885.925
16	7.5			0.752	1885.920
17	8			0.757	1885.915
18	8.5			0.760	1885.912
19	9			0.764	1885.908
20	9.5			0.770	1885.902
21	10			0.775	1885.897
22	10.5			0.780	1885.891
23	11			0.786	1885.886
24	11.5			0.791	1885.881
25	12			0.797	1885.875
26	12.5			0.802	1885.870
27	13			0.808	1885.864
28	13.5			0.811	1885.861
29	14			0.815	1885.857
30	14.5			0.819	1885.853
31	15			0.824	1885.848
32	15.5			0.828	1885.843
33	16			0.833	1885.839
34	16.5			0.839	1885.833
35	17			0.844	1885.827
36	17.5			0.850	1885.822
37	18			0.856	1885.816
38	18.5			0.862	1885.810
39	19			0.868	1885.804
40	19.5			0.874	1885.798

N°	PUNTO	V.AT	AL.INS	V.AD	COTA
41	20			0.879	1885.793
42	20.5			0.885	1885.787
43	21			0.891	1885.781
44	21.5			0.897	1885.775
45	22			0.904	1885.768
46	22.5			0.910	1885.762
47	23			0.916	1885.755
48	23.5			0.922	1885.750
49	24			0.927	1885.745
50	24.5			0.933	1885.739
51	25			0.939	1885.733
52	25.5			0.945	1885.727
53	26			0.951	1885.720
54	26.5			0.958	1885.714
55	27			0.964	1885.708
56	27.5			0.971	1885.700
57	28			0.979	1885.693
58	28.5			0.986	1885.686
59	29			0.993	1885.679
60	29.5			0.999	1885.673
61	30			1.006	1885.666
62	30.5			1.012	1885.660
63	31			1.018	1885.654
64	31.5			1.024	1885.647
65	32			1.031	1885.641
66	32.5			1.036	1885.636
67	33			1.040	1885.632
68	33.5			1.046	1885.626
69	34			1.051	1885.621
70	34.5			1.058	1885.614
71	35			1.066	1885.606
72	35.5			1.072	1885.600
73	36			1.079	1885.593
74	36.5			1.086	1885.586
75	37			1.093	1885.579
76	37.5			1.100	1885.572
77	38			1.106	1885.566
78	38.5			1.114	1885.558
79	39			1.122	1885.549
80	39.5			1.133	1885.539

N°	PUNTO	V.AT	AL.INS	V.AD	COTA
81	40			1.143	1885.528
82	40.5			1.151	1885.521
83	41			1.158	1885.514
84	41.5			1.167	1885.504
85	42			1.177	1885.495
86	42.5			1.189	1885.483
87	43			1.201	1885.470
88	43.5			1.212	1885.460
89	44			1.223	1885.449
90	44.5			1.234	1885.438
91	45			1.244	1885.428
92	45.5			1.255	1885.417
93	46			1.267	1885.405
94	46.5			1.275	1885.396
95	47			1.284	1885.388
96	47.5			1.294	1885.378
97	48			1.304	1885.368
98	48.5			1.313	1885.358
99	49			1.323	1885.349
100	49.5			1.346	1885.325
101	50			1.352	1885.320
102	50.5			1.356	1885.316
103	51			1.364	1885.308
104	51.5			1.372	1885.299
105	52			1.380	1885.291
106	52.5			1.390	1885.282
107	53			1.399	1885.273
108	53.5			1.407	1885.264
109	54			1.416	1885.256
110	54.5			1.427	1885.244
111	55			1.439	1885.233
112	55.5			1.451	1885.221
113	56			1.456	1885.216
114	56.5			1.463	1885.209
115	57			1.480	1885.192
116	57.5			1.489	1885.183
117	58			1.498	1885.174
118	58.5			1.509	1885.163
119	59			1.520	1885.152
120	59.5			1.526	1885.145
121	60			1.532	1885.139
122	60.5			1.540	1885.131
123	61			1.549	1885.123
124	61.5			1.554	1885.118
125	62			1.561	1885.111
126	62.5			1.574	1885.098
127	63			1.587	1885.085
128	63.5			1.594	1885.078
129	64			1.606	1885.066
130	64.5			1.615	1885.057

N°	PUNTO	V.AT	AL.INS	V.AD	COTA
131	65			1.624	1885.048
132	65.5			1.630	1885.042
133	66			1.634	1885.038
134	66.5			1.645	1885.027
135	67			1.649	1885.023
136	67.5			1.654	1885.018
137	68			1.660	1885.012
138	68.5			1.668	1885.004
139	69			1.675	1884.997
140	69.5			1.682	1884.990
141	70			1.686	1884.986
142	70.5			1.689	1884.983
143	71			1.694	1884.978
144	71.5			1.702	1884.970
145	72			1.707	1884.965
146	72.5			1.716	1884.956
147	73			1.725	1884.947
148	73.5			1.738	1884.934
149	74			1.750	1884.922
150	74.5			1.754	1884.918
151	75			1.767	1884.905
152	75.5			1.779	1884.893
153	76			1.791	1884.881
154	76.5			1.799	1884.873
155	77			1.804	1884.868
156	77.5			1.818	1884.854
157	78			1.823	1884.849
158	78.5			1.834	1884.838
159	79			1.844	1884.828
160	79.5			1.851	1884.821
161	80			1.857	1884.815
162	80.5			1.864	1884.808
163	81			1.872	1884.800
164	81.5			1.880	1884.792
165	82			1.884	1884.788
166	82.5			1.890	1884.782
167	83			1.893	1884.779
168	83.5			1.907	1884.765
169	84			1.919	1884.753
170	84.5			1.928	1884.744
171	85			1.936	1884.736
172	85.5			1.948	1884.724
173	86			1.959	1884.713
174	86.5			1.963	1884.709
175	87			1.970	1884.702
176	87.5			1.976	1884.696
177	88			1.981	1884.691
178	88.5			1.984	1884.688
179	89			1.991	1884.681
180	89.5			1.995	1884.677

N°	PUNTO	V.AT	AL.INS	V.AD	COTA
181	90			2.003	1884.669
182	90.5			2.016	1884.656
183	91			2.028	1884.644
184	91.5			2.042	1884.630
185	92			2.055	1884.617
186	92.5			2.067	1884.605
187	93			2.078	1884.594
188	93.5			2.087	1884.585
189	94			2.096	1884.576
190	94.5			2.107	1884.565
191	95			2.117	1884.555
192	95.5			2.128	1884.544
193	96			2.139	1884.533
194	96.5			2.144	1884.528
195	97			2.151	1884.521
196	97.5			2.154	1884.518
197	98			2.160	1884.512
198	98.5			2.165	1884.507
199	99			2.174	1884.498
200	99.5			2.184	1884.488
201	100			2.193	1884.479

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Univ. Ramos Quispe Alejandra  
**ESTUDIANTE CIV 502**  
**FACULTAD DE CIENCIAS Y TEGNOLOGÍA**

**Código del tramo: 03**

**Longitud del Tramo: 100 metros.**

**Nombre del tramo: El Portillo -La Pintada (Cruce Ruta 11 Villamontes - Entrada al proyecto múltiples san jacinto - oficinas)**

**Abscisa del tramo inicial: 0 m.**

**Abscisa del tramo final: 100 m.**

**Carril de vuelta**

**Huella 2**

Nº	PUNTO	V.AT	AL.INS	V.AD	COTA
1	0	0.636	1887.636		1887.000
2	0.5			0.639	1886.996
3	1			0.643	1886.993
4	1.5			0.649	1886.986
5	2			0.655	1886.980
6	2.5			0.661	1886.975
7	3			0.666	1886.969
8	3.5			0.672	1886.964
9	4			0.677	1886.959
10	4.5			0.681	1886.955
11	5			0.685	1886.951
12	5.5			0.689	1886.947
13	6			0.693	1886.943
14	6.5			0.697	1886.939
15	7			0.701	1886.935
16	7.5			0.704	1886.931
17	8			0.708	1886.928
18	8.5			0.712	1886.924
19	9			0.715	1886.920
20	9.5			0.720	1886.916
21	10			0.725	1886.911
22	10.5			0.729	1886.906
23	11			0.734	1886.901
24	11.5			0.739	1886.897
25	12			0.744	1886.892
26	12.5			0.747	1886.888
27	13			0.751	1886.885
28	13.5			0.756	1886.880
29	14			0.761	1886.875
30	14.5			0.766	1886.870
31	15			0.771	1886.864
32	15.5			0.776	1886.859
33	16			0.781	1886.854
34	16.5			0.786	1886.849
35	17			0.791	1886.844
36	17.5			0.798	1886.838
37	18			0.804	1886.832
38	18.5			0.810	1886.826
39	19			0.815	1886.820
40	19.5			0.821	1886.814

Nº	PUNTO	V.AT	AL.INS	V.AD	COTA
41	20			0.827	1886.809
42	20.5			0.833	1886.803
43	21			0.839	1886.797
44	21.5			0.845	1886.790
45	22			0.852	1886.783
46	22.5			0.859	1886.777
47	23			0.865	1886.771
48	23.5			0.872	1886.764
49	24			0.879	1886.756
50	24.5			0.887	1886.749
51	25			0.895	1886.741
52	25.5			0.901	1886.734
53	26			0.908	1886.728
54	26.5			0.914	1886.722
55	27			0.920	1886.716
56	27.5			0.927	1886.709
57	28			0.934	1886.701
58	28.5			0.942	1886.694
59	29			0.950	1886.686
60	29.5			0.957	1886.679
61	30			0.964	1886.672
62	30.5			0.970	1886.665
63	31			0.977	1886.659
64	31.5			0.984	1886.651
65	32			0.992	1886.644
66	32.5			0.999	1886.637
67	33			1.005	1886.630
68	33.5			1.011	1886.624
69	34			1.018	1886.618
70	34.5			1.026	1886.610
71	35			1.034	1886.602
72	35.5			1.042	1886.594
73	36			1.050	1886.586
74	36.5			1.057	1886.579
75	37			1.064	1886.571
76	37.5			1.072	1886.563
77	38			1.080	1886.556
78	38.5			1.085	1886.551
79	39			1.090	1886.546
80	39.5			1.098	1886.537

Nº	PUNTO	V.AT	AL.INS	V.AD	COTA
81	40			1.107	1886.529
82	40.5			1.116	1886.520
83	41			1.125	1886.511
84	41.5			1.134	1886.501
85	42			1.144	1886.491
86	42.5			1.151	1886.484
87	43			1.158	1886.477
88	43.5			1.168	1886.467
89	44			1.178	1886.458
90	44.5			1.187	1886.448
91	45			1.197	1886.439
92	45.5			1.208	1886.428
93	46			1.219	1886.416
94	46.5			1.231	1886.405
95	47			1.243	1886.393
96	47.5			1.250	1886.385
97	48			1.258	1886.378
98	48.5			1.264	1886.372
99	49			1.270	1886.366
100	49.5			1.280	1886.356
101	50			1.290	1886.346
102	50.5			1.301	1886.335
103	51			1.312	1886.323
104	51.5			1.322	1886.314
105	52			1.331	1886.305
106	52.5			1.337	1886.298
107	53			1.344	1886.292
108	53.5			1.354	1886.281
109	54			1.365	1886.271
110	54.5			1.375	1886.261
111	55			1.385	1886.250
112	55.5			1.396	1886.239
113	56			1.407	1886.229
114	56.5			1.417	1886.218
115	57			1.428	1886.208
116	57.5			1.439	1886.197
117	58			1.450	1886.186
118	58.5			1.460	1886.176
119	59			1.470	1886.165
120	59.5			1.478	1886.157
121	60			1.487	1886.149
122	60.5			1.494	1886.142
123	61			1.501	1886.134
124	61.5			1.516	1886.120
125	62			1.530	1886.106
126	62.5			1.539	1886.096
127	63			1.549	1886.087
128	63.5			1.557	1886.078
129	64			1.566	1886.069
130	64.5			1.577	1886.059

Nº	PUNTO	V.AT	AL.INS	V.AD	COTA
131	65			1.588	1886.048
132	65.5			1.600	1886.036
133	66			1.612	1886.024
134	66.5			1.621	1886.015
135	67			1.630	1886.006
136	67.5			1.641	1885.995
137	68			1.652	1885.984
138	68.5			1.661	1885.974
139	69			1.671	1885.964
140	69.5			1.680	1885.955
141	70			1.689	1885.947
142	70.5			1.698	1885.938
143	71			1.707	1885.929
144	71.5			1.719	1885.917
145	72			1.730	1885.905
146	72.5			1.743	1885.893
147	73			1.755	1885.881
148	73.5			1.767	1885.868
149	74			1.780	1885.856
150	74.5			1.793	1885.842
151	75			1.807	1885.829
152	75.5			1.820	1885.816
153	76			1.833	1885.803
154	76.5			1.845	1885.791
155	77			1.857	1885.778
156	77.5			1.870	1885.766
157	78			1.883	1885.753
158	78.5			1.895	1885.741
159	79			1.907	1885.729
160	79.5			1.918	1885.718
161	80			1.929	1885.707
162	80.5			1.940	1885.695
163	81			1.951	1885.684
164	81.5			1.961	1885.675
165	82			1.970	1885.665
166	82.5			1.982	1885.654
167	83			1.993	1885.642
168	83.5			2.002	1885.633
169	84			2.011	1885.624
170	84.5			2.024	1885.611
171	85			2.037	1885.598
172	85.5			2.051	1885.585
173	86			2.064	1885.572
174	86.5			2.075	1885.560
175	87			2.086	1885.549
176	87.5			2.096	1885.539
177	88			2.106	1885.530
178	88.5			2.118	1885.518
179	89			2.130	1885.506
180	89.5			2.142	1885.494

N°	PUNTO	V.AT	AL.INS	V.AD	COTA
181	90			2.154	1885.482
182	90.5			2.165	1885.471
183	91			2.176	1885.460
184	91.5			2.189	1885.447
185	92			2.202	1885.434
186	92.5			2.218	1885.417
187	93			2.235	1885.401
188	93.5			2.245	1885.391
189	94			2.254	1885.381
190	94.5			2.266	1885.370
191	95			2.277	1885.359
192	95.5			2.288	1885.348
193	96			2.299	1885.337
194	96.5			2.312	1885.324
195	97			2.325	1885.310
196	97.5			2.339	1885.297
197	98			2.352	1885.284
198	98.5			2.362	1885.274
199	99			2.371	1885.265
200	99.5			2.382	1885.254
201	100			2.393	1885.243

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Ing. Chambi Gareca Pablo  
**RESPONSABLE DEL LABORATORIA DE  
TOPOGRAFÍA**  
**FACULTAD DE CIENCIAS Y TEGNOLOGÍA**

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Univ. Ramos Quispe Alejandra  
**ESTUDIANTE CIV 502**  
**FACULTAD DE CIENCIAS Y TEGNOLOGÍA**



**Código del tramo:** 04

**Longitud del Tramo:** 100 metros.

**Nombre del tramo:** Carretera San Mateo – Sella (Monte Méndez - Barrio El Taco)

**Abscisa del tramo inicial:** 0 m.

**Abscisa del tramo final:** 100 m.

**Carril de ida**

**Huella 1**

Nº	PUNTO	V.AT	AL.INS	V.AD	COTA	Nº	PUNTO	V.AT	AL.INS	V.AD	COTA
1	0	0.829	1978.829		1978	41	20			1.064	1977.764
2	0.5			0.836	1977.993	42	20.5			1.071	1977.757
3	1			0.843	1977.986	43	21			1.078	1977.751
4	1.5			0.851	1977.978	44	21.5			1.085	1977.744
5	2			0.860	1977.969	45	22			1.091	1977.737
6	2.5			0.864	1977.965	46	22.5			1.099	1977.730
7	3			0.868	1977.960	47	23			1.107	1977.722
8	3.5			0.874	1977.954	48	23.5			1.115	1977.714
9	4			0.880	1977.948	49	24			1.123	1977.706
10	4.5			0.886	1977.943	50	24.5			1.130	1977.698
11	5			0.892	1977.937	51	25			1.137	1977.691
12	5.5			0.897	1977.932	52	25.5			1.146	1977.683
13	6			0.902	1977.927	53	26			1.154	1977.675
14	6.5			0.907	1977.922	54	26.5			1.162	1977.667
15	7			0.912	1977.917	55	27			1.169	1977.660
16	7.5			0.918	1977.911	56	27.5			1.176	1977.653
17	8			0.924	1977.905	57	28			1.182	1977.647
18	8.5			0.929	1977.900	58	28.5			1.187	1977.642
19	9			0.934	1977.895	59	29			1.189	1977.640
20	9.5			0.939	1977.890	60	29.5			1.192	1977.637
21	10			0.944	1977.885	61	30			1.195	1977.633
22	10.5			0.949	1977.879	62	30.5			1.203	1977.626
23	11			0.955	1977.874	63	31			1.211	1977.618
24	11.5			0.961	1977.868	64	31.5			1.218	1977.610
25	12			0.968	1977.861	65	32			1.226	1977.603
26	12.5			0.973	1977.855	66	32.5			1.236	1977.593
27	13			0.979	1977.850	67	33			1.246	1977.583
28	13.5			0.985	1977.844	68	33.5			1.260	1977.569
29	14			0.990	1977.839	69	34			1.275	1977.554
30	14.5			0.996	1977.833	70	34.5			1.283	1977.546
31	15			1.002	1977.827	71	35			1.292	1977.537
32	15.5			1.007	1977.822	72	35.5			1.299	1977.530
33	16			1.012	1977.817	73	36			1.306	1977.522
34	16.5			1.026	1977.803	74	36.5			1.316	1977.513
35	17			1.029	1977.800	75	37			1.325	1977.504
36	17.5			1.039	1977.790	76	37.5			1.333	1977.496
37	18			1.040	1977.789	77	38			1.341	1977.488
38	18.5			1.046	1977.783	78	38.5			1.349	1977.480
39	19			1.053	1977.776	79	39			1.356	1977.473
40	19.5			1.059	1977.770	80	39.5			1.366	1977.462

N°	PUNTO	V.AT	AL.INS	V.AD	COTA
81	40			1.377	1977.452
82	40.5			1.381	1977.448
83	41			1.385	1977.443
84	41.5			1.393	1977.436
85	42			1.400	1977.428
86	42.5			1.408	1977.421
87	43			1.416	1977.413
88	43.5			1.423	1977.406
89	44			1.431	1977.398
90	44.5			1.439	1977.390
91	45			1.446	1977.382
92	45.5			1.454	1977.375
93	46			1.461	1977.368
94	46.5			1.468	1977.361
95	47			1.475	1977.354
96	47.5			1.482	1977.347
97	48			1.489	1977.340
98	48.5			1.497	1977.331
99	49			1.506	1977.323
100	49.5			1.512	1977.317
101	50			1.519	1977.310
102	50.5			1.529	1977.300
103	51			1.538	1977.290
104	51.5			1.544	1977.285
105	52			1.550	1977.279
106	52.5			1.559	1977.270
107	53			1.568	1977.261
108	53.5			1.578	1977.250
109	54			1.589	1977.240
110	54.5			1.598	1977.231
111	55			1.607	1977.222
112	55.5			1.616	1977.213
113	56			1.626	1977.203
114	56.5			1.636	1977.193
115	57			1.645	1977.183
116	57.5			1.655	1977.174
117	58			1.664	1977.165
118	58.5			1.672	1977.157
119	59			1.680	1977.149
120	59.5			1.691	1977.137
121	60			1.703	1977.126
122	60.5			1.710	1977.118
123	61			1.718	1977.111
124	61.5			1.726	1977.103
125	62			1.734	1977.095
126	62.5			1.744	1977.085
127	63			1.754	1977.074
128	63.5			1.762	1977.066
129	64			1.771	1977.058
130	64.5			1.776	1977.053

N°	PUNTO	V.AT	AL.INS	V.AD	COTA
131	65			1.781	1977.048
132	65.5			1.790	1977.038
133	66			1.799	1977.029
134	66.5			1.806	1977.023
135	67			1.812	1977.017
136	67.5			1.817	1977.012
137	68			1.822	1977.007
138	68.5			1.830	1976.999
139	69			1.837	1976.992
140	69.5			1.844	1976.984
141	70			1.852	1976.977
142	70.5			1.858	1976.971
143	71			1.865	1976.964
144	71.5			1.873	1976.956
145	72			1.881	1976.947
146	72.5			1.888	1976.941
147	73			1.895	1976.934
148	73.5			1.903	1976.926
149	74			1.911	1976.917
150	74.5			1.924	1976.905
151	75			1.936	1976.893
152	75.5			1.945	1976.884
153	76			1.955	1976.874
154	76.5			1.963	1976.866
155	77			1.971	1976.858
156	77.5			1.980	1976.849
157	78			1.990	1976.839
158	78.5			1.999	1976.830
159	79			2.008	1976.821
160	79.5			2.016	1976.813
161	80			2.023	1976.806
162	80.5			2.035	1976.794
163	81			2.046	1976.783
164	81.5			2.053	1976.775
165	82			2.061	1976.768
166	82.5			2.070	1976.759
167	83			2.079	1976.750
168	83.5			2.087	1976.742
169	84			2.095	1976.734
170	84.5			2.101	1976.727
171	85			2.108	1976.721
172	85.5			2.115	1976.713
173	86			2.123	1976.706
174	86.5			2.131	1976.698
175	87			2.140	1976.689
176	87.5			2.147	1976.682
177	88			2.154	1976.674
178	88.5			2.161	1976.668
179	89			2.167	1976.662
180	89.5			2.176	1976.652

N°	PUNTO	V.AT	AL.INS	V.AD	COTA
181	90			2.186	1976.643
182	90.5			2.189	1976.640
183	91			2.190	1976.639
184	91.5			2.193	1976.635
185	92			2.201	1976.627
186	92.5			2.209	1976.619
187	93			2.217	1976.612
188	93.5			2.227	1976.602
189	94			2.237	1976.592
190	94.5			2.245	1976.584
191	95			2.254	1976.575
192	95.5			2.262	1976.567
193	96			2.271	1976.558
194	96.5			2.281	1976.548
195	97			2.291	1976.538
196	97.5			2.299	1976.530
197	98			2.308	1976.521
198	98.5			2.315	1976.514
199	99			2.323	1976.506
200	99.5			2.330	1976.499
201	100			2.337	1976.492

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 Ing. Chambi Gareca Pablo

**RESPONSABLE DEL LABORATORIA DE  
 TOPOGRAFÍA  
 FACULTAD DE CIENCIAS Y TEGNOLOGÍA**

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 Univ. Ramos Quispe Alejandra

**ESTUDIANTE CIV 502  
 FACULTAD DE CIENCIAS Y TEGNOLOGÍA**

**Código del tramo:** 04

**Longitud del Tramo:** 100 metros.

**Nombre del tramo:** Carretera San Mateo – Sella (Monte Méndez - Barrio El Taco)

**Abscisa del tramo inicial:** 0 m.

**Abscisa del tramo final:** 100 m.

**Carril de ida**

**Huella 2**

Nº	PUNTO	V.AT	AL.INS	V.AD	COTA
1	0	0.795	1979.795		1979
2	0.5			0.801	1978.994
3	1			0.807	1978.988
4	1.5			0.812	1978.983
5	2			0.817	1978.978
6	2.5			0.822	1978.973
7	3			0.827	1978.968
8	3.5			0.833	1978.962
9	4			0.838	1978.957
10	4.5			0.844	1978.951
11	5			0.850	1978.945
12	5.5			0.855	1978.940
13	6			0.860	1978.935
14	6.5			0.865	1978.930
15	7			0.870	1978.925
16	7.5			0.875	1978.920
17	8			0.881	1978.914
18	8.5			0.886	1978.909
19	9			0.891	1978.904
20	9.5			0.896	1978.899
21	10			0.901	1978.894
22	10.5			0.905	1978.890
23	11			0.910	1978.885
24	11.5			0.915	1978.880
25	12			0.920	1978.875
26	12.5			0.926	1978.869
27	13			0.932	1978.863
28	13.5			0.938	1978.857
29	14			0.944	1978.851
30	14.5			0.950	1978.845
31	15			0.956	1978.839
32	15.5			0.961	1978.834
33	16			0.966	1978.829
34	16.5			0.972	1978.823
35	17			0.977	1978.818
36	17.5			0.984	1978.811
37	18			0.991	1978.804
38	18.5			0.999	1978.796
39	19			1.006	1978.789
40	19.5			1.013	1978.782

Nº	PUNTO	V.AT	AL.INS	V.AD	COTA
41	20			1.020	1978.775
42	20.5			1.029	1978.766
43	21			1.038	1978.757
44	21.5			1.043	1978.752
45	22			1.048	1978.747
46	22.5			1.056	1978.739
47	23			1.063	1978.732
48	23.5			1.072	1978.723
49	24			1.082	1978.713
50	24.5			1.089	1978.706
51	25			1.097	1978.698
52	25.5			1.103	1978.692
53	26			1.109	1978.686
54	26.5			1.116	1978.679
55	27			1.122	1978.673
56	27.5			1.137	1978.658
57	28			1.152	1978.643
58	28.5			1.161	1978.634
59	29			1.170	1978.625
60	29.5			1.178	1978.617
61	30			1.187	1978.608
62	30.5			1.196	1978.599
63	31			1.206	1978.589
64	31.5			1.217	1978.578
65	32			1.219	1978.576
66	32.5			1.221	1978.574
67	33			1.224	1978.571
68	33.5			1.229	1978.566
69	34			1.237	1978.558
70	34.5			1.244	1978.551
71	35			1.252	1978.543
72	35.5			1.260	1978.535
73	36			1.268	1978.527
74	36.5			1.277	1978.518
75	37			1.285	1978.510
76	37.5			1.293	1978.502
77	38			1.301	1978.494
78	38.5			1.309	1978.486
79	39			1.316	1978.479
80	39.5			1.324	1978.471

N°	PUNTO	V.AT	AL.INS	V.AD	COTA
81	40			1.331	1978.464
82	40.5			1.340	1978.455
83	41			1.349	1978.446
84	41.5			1.361	1978.434
85	42			1.374	1978.421
86	42.5			1.380	1978.415
87	43			1.386	1978.409
88	43.5			1.392	1978.403
89	44			1.397	1978.398
90	44.5			1.404	1978.391
91	45			1.411	1978.384
92	45.5			1.417	1978.378
93	46			1.424	1978.371
94	46.5			1.431	1978.364
95	47			1.439	1978.356
96	47.5			1.449	1978.346
97	48			1.459	1978.336
98	48.5			1.466	1978.329
99	49			1.472	1978.323
100	49.5			1.477	1978.318
101	50			1.482	1978.313
102	50.5			1.494	1978.301
103	51			1.506	1978.289
104	51.5			1.514	1978.281
105	52			1.522	1978.273
106	52.5			1.531	1978.264
107	53			1.540	1978.255
108	53.5			1.550	1978.245
109	54			1.560	1978.235
110	54.5			1.567	1978.228
111	55			1.573	1978.222
112	55.5			1.584	1978.211
113	56			1.595	1978.200
114	56.5			1.603	1978.192
115	57			1.612	1978.183
116	57.5			1.547	1978.248
117	58			1.626	1978.169
118	58.5			1.637	1978.158
119	59			1.648	1978.147
120	59.5			1.655	1978.140
121	60			1.662	1978.133
122	60.5			1.672	1978.123
123	61			1.682	1978.113
124	61.5			1.691	1978.104
125	62			1.699	1978.096
126	62.5			1.708	1978.087
127	63			1.717	1978.078
128	63.5			1.723	1978.072
129	64			1.730	1978.065
130	64.5			1.739	1978.056

N°	PUNTO	V.AT	AL.INS	V.AD	COTA
131	65			1.747	1978.048
132	65.5			1.754	1978.041
133	66			1.761	1978.034
134	66.5			1.768	1978.027
135	67			1.775	1978.020
136	67.5			1.781	1978.014
137	68			1.787	1978.008
138	68.5			1.794	1978.001
139	69			1.801	1977.994
140	69.5			1.807	1977.988
141	70			1.813	1977.982
142	70.5			1.823	1977.972
143	71			1.832	1977.963
144	71.5			1.839	1977.956
145	72			1.846	1977.949
146	72.5			1.853	1977.942
147	73			1.861	1977.934
148	73.5			1.869	1977.926
149	74			1.877	1977.918
150	74.5			1.887	1977.908
151	75			1.896	1977.899
152	75.5			1.905	1977.890
153	76			1.913	1977.882
154	76.5			1.923	1977.872
155	77			1.933	1977.862
156	77.5			1.942	1977.853
157	78			1.951	1977.844
158	78.5			1.963	1977.832
159	79			1.974	1977.821
160	79.5			1.987	1977.808
161	80			1.999	1977.796
162	80.5			2.005	1977.790
163	81			2.011	1977.784
164	81.5			2.020	1977.775
165	82			2.028	1977.767
166	82.5			2.037	1977.758
167	83			2.045	1977.750
168	83.5			2.055	1977.740
169	84			2.064	1977.731
170	84.5			2.072	1977.723
171	85			2.080	1977.715
172	85.5			2.090	1977.705
173	86			2.099	1977.696
174	86.5			2.110	1977.685
175	87			2.122	1977.673
176	87.5			2.131	1977.664
177	88			2.140	1977.655
178	88.5			2.145	1977.650
179	89			2.151	1977.644
180	89.5			2.151	1977.644

N°	PUNTO	V.AT	AL.INS	V.AD	COTA
181	90			2.151	1977.644
182	90.5			2.159	1977.636
183	91			2.168	1977.627
184	91.5			2.173	1977.622
185	92			2.178	1977.617
186	92.5			2.185	1977.610
187	93			2.192	1977.603
188	93.5			2.200	1977.595
189	94			2.209	1977.586
190	94.5			2.217	1977.578
191	95			2.226	1977.569
192	95.5			2.234	1977.561
193	96			2.242	1977.553
194	96.5			2.252	1977.543
195	97			2.261	1977.534
196	97.5			2.271	1977.524
197	98			2.280	1977.515
198	98.5			2.289	1977.506
199	99			2.298	1977.497
200	99.5			2.308	1977.487
201	100			2.318	1977.477

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Ing. Chambi Gareca Pablo  
**RESPONSABLE DEL LABORATORIA DE  
TOPOGRAFÍA**  
**FACULTAD DE CIENCIAS Y TEGNOLOGÍA**

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Univ. Ramos Quispe Alejandra  
**ESTUDIANTE CIV 502**  
**FACULTAD DE CIENCIAS Y TEGNOLOGÍA**

**Código del tramo:** 04

**Longitud del Tramo:** 100 metros.

**Nombre del tramo:** Carretera San Mateo – Sella (Monte Méndez - Barrio El Taco)

**Abscisa del tramo inicial:** 0 m.

**Abscisa del tramo final:** 100 m.

**Carril de vuelta**

**Huella 1**

Nº	PUNTO	V.AT	AL.INS	V.AD	COTA	Nº	PUNTO	V.AT	AL.INS	V.AD	COTA
1	0	0.828	1962.828		1962.000	41	20			1.064	1961.763
2	0.5			0.836	1961.992	42	20.5			1.071	1961.756
3	1			0.843	1961.985	43	21			1.078	1961.750
4	1.5			0.851	1961.977	44	21.5			1.085	1961.743
5	2			0.860	1961.968	45	22			1.091	1961.736
6	2.5			0.864	1961.964	46	22.5			1.099	1961.729
7	3			0.868	1961.959	47	23			1.107	1961.721
8	3.5			0.874	1961.953	48	23.5			1.108	1961.720
9	4			0.880	1961.947	49	24			1.118	1961.710
10	4.5			0.886	1961.942	50	24.5			1.130	1961.697
11	5			0.892	1961.936	51	25			1.137	1961.690
12	5.5			0.897	1961.931	52	25.5			1.146	1961.682
13	6			0.902	1961.926	53	26			1.148	1961.680
14	6.5			0.907	1961.921	54	26.5			1.162	1961.666
15	7			0.912	1961.916	55	27			1.169	1961.659
16	7.5			0.918	1961.910	56	27.5			1.168	1961.660
17	8			0.924	1961.904	57	28			1.182	1961.646
18	8.5			0.929	1961.899	58	28.5			1.178	1961.650
19	9			0.934	1961.894	59	29			1.188	1961.640
20	9.5			0.939	1961.889	60	29.5			1.198	1961.630
21	10			0.944	1961.884	61	30			1.195	1961.632
22	10.5			0.949	1961.878	62	30.5			1.203	1961.625
23	11			0.955	1961.873	63	31			1.211	1961.617
24	11.5			0.961	1961.867	64	31.5			1.218	1961.609
25	12			0.968	1961.860	65	32			1.226	1961.602
26	12.5			0.973	1961.854	66	32.5			1.236	1961.592
27	13			0.979	1961.849	67	33			1.246	1961.582
28	13.5			0.985	1961.843	68	33.5			1.248	1961.580
29	14			0.990	1961.838	69	34			1.258	1961.570
30	14.5			0.996	1961.832	70	34.5			1.268	1961.560
31	15			1.002	1961.826	71	35			1.292	1961.536
32	15.5			1.007	1961.821	72	35.5			1.288	1961.540
33	16			1.012	1961.816	73	36			1.306	1961.521
34	16.5			1.018	1961.810	74	36.5			1.316	1961.512
35	17			1.028	1961.800	75	37			1.325	1961.503
36	17.5			1.039	1961.789	76	37.5			1.333	1961.495
37	18			1.038	1961.789	77	38			1.341	1961.487
38	18.5			1.046	1961.782	78	38.5			1.349	1961.479
39	19			1.053	1961.775	79	39			1.356	1961.472
40	19.5			1.059	1961.769	80	39.5			1.366	1961.461

Nº	PUNTO	V.AT	AL.INS	V.AD	COTA
81	40			1.377	1961.451
82	40.5			1.381	1961.447
83	41			1.385	1961.442
84	41.5			1.393	1961.435
85	42			1.400	1961.427
86	42.5			1.408	1961.420
87	43			1.416	1961.412
88	43.5			1.423	1961.405
89	44			1.431	1961.397
90	44.5			1.439	1961.389
91	45			1.446	1961.381
92	45.5			1.454	1961.374
93	46			1.461	1961.367
94	46.5			1.468	1961.360
95	47			1.475	1961.353
96	47.5			1.482	1961.346
97	48			1.489	1961.339
98	48.5			1.497	1961.330
99	49			1.506	1961.322
100	49.5			1.512	1961.316
101	50			1.519	1961.309
102	50.5			1.529	1961.299
103	51			1.538	1961.289
104	51.5			1.544	1961.284
105	52			1.550	1961.278
106	52.5			1.559	1961.269
107	53			1.568	1961.260
108	53.5			1.578	1961.249
109	54			1.578	1961.250
110	54.5			1.588	1961.240
111	55			1.607	1961.221
112	55.5			1.616	1961.212
113	56			1.626	1961.202
114	56.5			1.636	1961.192
115	57			1.645	1961.182
116	57.5			1.655	1961.173
117	58			1.664	1961.164
118	58.5			1.672	1961.156
119	59			1.680	1961.148
120	59.5			1.691	1961.136
121	60			1.703	1961.125
122	60.5			1.710	1961.117
123	61			1.718	1961.110
124	61.5			1.726	1961.102
125	62			1.734	1961.094
126	62.5			1.744	1961.084
127	63			1.754	1961.073
128	63.5			1.762	1961.065
129	64			1.771	1961.057
130	64.5			1.776	1961.052

Nº	PUNTO	V.AT	AL.INS	V.AD	COTA
131	65			1.781	1961.047
132	65.5			1.790	1961.037
133	66			1.799	1961.028
134	66.5			1.806	1961.022
135	67			1.812	1961.016
136	67.5			1.817	1961.011
137	68			1.822	1961.006
138	68.5			1.830	1960.998
139	69			1.837	1960.991
140	69.5			1.844	1960.983
141	70			1.852	1960.976
142	70.5			1.858	1960.970
143	71			1.865	1960.963
144	71.5			1.873	1960.955
145	72			1.881	1960.946
146	72.5			1.888	1960.940
147	73			1.895	1960.933
148	73.5			1.903	1960.925
149	74			1.911	1960.916
150	74.5			1.924	1960.904
151	75			1.936	1960.892
152	75.5			1.945	1960.883
153	76			1.955	1960.873
154	76.5			1.963	1960.865
155	77			1.971	1960.857
156	77.5			1.980	1960.848
157	78			1.990	1960.838
158	78.5			1.999	1960.829
159	79			2.008	1960.820
160	79.5			2.016	1960.812
161	80			2.023	1960.805
162	80.5			2.035	1960.793
163	81			2.046	1960.782
164	81.5			2.053	1960.774
165	82			2.061	1960.767
166	82.5			2.070	1960.758
167	83			2.079	1960.749
168	83.5			2.087	1960.741
169	84			2.095	1960.733
170	84.5			2.101	1960.726
171	85			2.108	1960.720
172	85.5			2.115	1960.712
173	86			2.123	1960.705
174	86.5			2.131	1960.697
175	87			2.140	1960.688
176	87.5			2.147	1960.681
177	88			2.154	1960.673
178	88.5			2.161	1960.667
179	89			2.167	1960.661
180	89.5			2.176	1960.651



N°	PUNTO	V.AT	AL.INS	V.AD	COTA
181	90			2.186	1960.642
182	90.5			2.185	1960.642
183	91			2.185	1960.643
184	91.5			2.193	1960.634
185	92			2.201	1960.626
186	92.5			2.209	1960.618
187	93			2.217	1960.611
188	93.5			2.227	1960.601
189	94			2.237	1960.591
190	94.5			2.245	1960.583
191	95			2.254	1960.574
192	95.5			2.262	1960.566
193	96			2.271	1960.557
194	96.5			2.281	1960.547
195	97			2.291	1960.537
196	97.5			2.299	1960.529
197	98			2.308	1960.520
198	98.5			2.315	1960.513
199	99			2.323	1960.505
200	99.5			2.330	1960.498
201	100			2.337	1960.491

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Ing. Chambi Gareca Pablo

**RESPONSABLE DEL LABORATORIA DE  
TOPOGRAFÍA**

**FACULTAD DE CIENCIAS Y TEGNOLOGÍA**

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Univ. Ramos Quispe Alejandra

**ESTUDIANTE CIV 502**

**FACULTAD DE CIENCIAS Y TEGNOLOGÍA**

**Código del tramo:** 04

**Longitud del Tramo:** 100 metros.

**Nombre del tramo:** Carretera San Mateo – Sella (Monte Méndez - Barrio El Taco)

**Abscisa del tramo inicial:** 0 m.

**Abscisa del tramo final:** 100 m.

**Carril de vuelta**

**Huella 2**

Nº	PUNTO	V.AT	AL.INS	V.AD	COTA
1	0	0.794	1963.794		1963.000
2	0.5			0.800	1962.994
3	1			0.804	1962.990
4	1.5			0.806	1962.988
5	2			0.812	1962.982
6	2.5			0.816	1962.978
7	3			0.820	1962.974
8	3.5			0.825	1962.969
9	4			0.832	1962.962
10	4.5			0.836	1962.958
11	5			0.844	1962.950
12	5.5			0.847	1962.947
13	6			0.855	1962.939
14	6.5			0.866	1962.928
15	7			0.874	1962.920
16	7.5			0.881	1962.913
17	8			0.888	1962.906
18	8.5			0.898	1962.896
19	9			0.906	1962.888
20	9.5			0.918	1962.876
21	10			0.926	1962.868
22	10.5			0.935	1962.859
23	11			0.939	1962.855
24	11.5			0.946	1962.848
25	12			0.950	1962.844
26	12.5			0.955	1962.839
27	13			0.962	1962.832
28	13.5			0.966	1962.828
29	14			0.971	1962.823
30	14.5			0.977	1962.817
31	15			0.983	1962.811
32	15.5			0.989	1962.805
33	16			0.997	1962.797
34	16.5			1.002	1962.792
35	17			1.006	1962.788
36	17.5			1.014	1962.780
37	18			1.021	1962.773
38	18.5			1.026	1962.768
39	19			1.031	1962.763
40	19.5			1.039	1962.755

Nº	PUNTO	V.AT	AL.INS	V.AD	COTA
41	20			1.046	1962.748
42	20.5			1.052	1962.742
43	21			1.055	1962.739
44	21.5			1.062	1962.732
45	22			1.066	1962.728
46	22.5			1.075	1962.719
47	23			1.079	1962.715
48	23.5			1.087	1962.707
49	24			1.096	1962.698
50	24.5			1.107	1962.687
51	25			1.115	1962.679
52	25.5			1.122	1962.672
53	26			1.126	1962.668
54	26.5			1.132	1962.662
55	27			1.139	1962.655
56	27.5			1.147	1962.647
57	28			1.156	1962.638
58	28.5			1.171	1962.623
59	29			1.178	1962.616
60	29.5			1.186	1962.608
61	30			1.198	1962.596
62	30.5			1.206	1962.588
63	31			1.215	1962.579
64	31.5			1.226	1962.568
65	32			1.232	1962.562
66	32.5			1.236	1962.558
67	33			1.244	1962.550
68	33.5			1.252	1962.542
69	34			1.258	1962.536
70	34.5			1.267	1962.527
71	35			1.276	1962.518
72	35.5			1.282	1962.512
73	36			1.287	1962.507
74	36.5			1.297	1962.497
75	37			1.301	1962.493
76	37.5			1.309	1962.485
77	38			1.315	1962.479
78	38.5			1.319	1962.475
79	39			1.325	1962.469
80	39.5			1.331	1962.463

Nº	PUNTO	V.AT	AL.INS	V.AD	COTA
81	40			1.337	1962.457
82	40.5			1.344	1962.450
83	41			1.348	1962.446
84	41.5			1.356	1962.438
85	42			1.369	1962.425
86	42.5			1.375	1962.419
87	43			1.383	1962.411
88	43.5			1.386	1962.408
89	44			1.398	1962.396
90	44.5			1.407	1962.387
91	45			1.414	1962.380
92	45.5			1.420	1962.374
93	46			1.426	1962.368
94	46.5			1.432	1962.362
95	47			1.438	1962.356
96	47.5			1.443	1962.351
97	48			1.447	1962.347
98	48.5			1.453	1962.341
99	49			1.458	1962.336
100	49.5			1.466	1962.328
101	50			1.478	1962.316
102	50.5			1.485	1962.309
103	51			1.496	1962.298
104	51.5			1.502	1962.292
105	52			1.507	1962.287
106	52.5			1.514	1962.280
107	53			1.518	1962.276
108	53.5			1.522	1962.272
109	54			1.527	1962.267
110	54.5			1.534	1962.260
111	55			1.539	1962.255
112	55.5			1.546	1962.248
113	56			1.554	1962.240
114	56.5			1.558	1962.236
115	57			1.572	1962.222
116	57.5			1.578	1962.216
117	58			1.585	1962.209
118	58.5			1.596	1962.198
119	59			1.603	1962.191
120	59.5			1.608	1962.186
121	60			1.613	1962.181
122	60.5			1.617	1962.177
123	61			2.626	1961.168
124	61.5			1.637	1962.157
125	62			1.642	1962.152
126	62.5			1.648	1962.146
127	63			1.655	1962.139
128	63.5			1.662	1962.132
129	64			1.666	1962.128
130	64.5			1.670	1962.124

Nº	PUNTO	V.AT	AL.INS	V.AD	COTA
131	65			1.675	1962.119
132	65.5			1.697	1962.097
133	66			1.700	1962.094
134	66.5			1.705	1962.089
135	67			1.713	1962.081
136	67.5			1.719	1962.075
137	68			1.726	1962.068
138	68.5			1.734	1962.060
139	69			1.740	1962.054
140	69.5			1.745	1962.049
141	70			1.751	1962.043
142	70.5			1.756	1962.038
143	71			1.762	1962.032
144	71.5			1.766	1962.028
145	72			1.771	1962.023
146	72.5			1.775	1962.019
147	73			1.779	1962.015
148	73.5			1.785	1962.009
149	74			1.796	1961.998
150	74.5			1.805	1961.989
151	75			1.812	1961.982
152	75.5			1.817	1961.977
153	76			1.822	1961.972
154	76.5			1.824	1961.970
155	77			1.829	1961.965
156	77.5			1.836	1961.958
157	78			1.842	1961.952
158	78.5			1.847	1961.947
159	79			1.853	1961.941
160	79.5			1.857	1961.937
161	80			1.862	1961.932
162	80.5			1.867	1961.927
163	81			1.871	1961.923
164	81.5			1.876	1961.918
165	82			1.883	1961.911
166	82.5			1.889	1961.905
167	83			1.895	1961.899
168	83.5			1.904	1961.890
169	84			1.907	1961.887
170	84.5			1.915	1961.879
171	85			1.918	1961.876
172	85.5			1.926	1961.868
173	86			1.934	1961.860
174	86.5			1.938	1961.856
175	87			1.945	1961.849
176	87.5			1.953	1961.841
177	88			1.955	1961.839
178	88.5			1.962	1961.832
179	89			1.967	1961.827
180	89.5			1.974	1961.820

N°	PUNTO	V.AT	AL.INS	V.AD	COTA
181	90			1.982	1961.812
182	90.5			1.986	1961.808
183	91			1.994	1961.800
184	91.5			1.997	1961.797
185	92			2.006	1961.788
186	92.5			2.013	1961.781
187	93			2.019	1961.775
188	93.5			2.022	1961.772
189	94			2.026	1961.768
190	94.5			2.033	1961.761
191	95			2.036	1961.758
192	95.5			2.043	1961.751
193	96			2.047	1961.747
194	96.5			2.052	1961.742
195	97			2.056	1961.738
196	97.5			2.061	1961.733
197	98			2.066	1961.728
198	98.5			2.070	1961.724
199	99			2.074	1961.720
200	99.5			2.077	1961.717
201	100			2.080	1961.714

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**Ing. Chambi Gareca Pablo**  
**RESPONSABLE DEL LABORATORIA DE**  
**TOPOGRAFÍA**  
**FACULTAD DE CIENCIAS Y TEGNOLOGÍA**

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**Univ. Ramos Quispe Alejandra**  
**ESTUDIANTE CIV 502**  
**FACULTAD DE CIENCIAS Y TEGNOLOGÍA**

**Código del tramo: 05**

**Longitud del Tramo: 100 metros.**

**Nombre del tramo: Ruta Nacional 1 (Cruce Calamuchita – Entrada a Muturayo)**

**Abscisa del tramo inicial: 0 m.**

**Abscisa del tramo final: 100 m.**

**Carril de ida**

**Huella 1**

N°	PUNTO	V.AT	AL.INS	V.AD	COTA
1	0	1.575	1696.575		1695
2	0.5			1.574	1695.001
3	1			1.574	1695.001
4	1.5			1.572	1695.003
5	2			1.570	1695.005
6	2.5			1.570	1695.005
7	3			1.570	1695.005
8	3.5			1.570	1695.005
9	4			1.570	1695.005
10	4.5			1.570	1695.005
11	5			1.570	1695.005
12	5.5			1.569	1695.006
13	6			1.568	1695.007
14	6.5			1.568	1695.007
15	7			1.569	1695.006
16	7.5			1.569	1695.006
17	8			1.568	1695.007
18	8.5			1.566	1695.009
19	9			1.564	1695.011
20	9.5			1.562	1695.013
21	10			1.561	1695.014
22	10.5			1.561	1695.014
23	11			1.560	1695.015
24	11.5			1.559	1695.016
25	12			1.557	1695.018
26	12.5			1.556	1695.019
27	13			1.554	1695.021
28	13.5			1.553	1695.022
29	14			1.552	1695.023
30	14.5			1.549	1695.026
31	15			1.547	1695.028
32	15.5			1.545	1695.030
33	16			1.543	1695.032
34	16.5			1.540	1695.035
35	17			1.537	1695.038
36	17.5			1.535	1695.040
37	18			1.533	1695.042
38	18.5			1.530	1695.045
39	19			1.528	1695.047
40	19.5			1.526	1695.049

N°	PUNTO	V.AT	AL.INS	V.AD	COTA
41	20			1.524	1695.051
42	20.5			1.524	1695.051
43	21			1.523	1695.052
44	21.5			1.520	1695.055
45	22			1.516	1695.059
46	22.5			1.513	1695.062
47	23			1.510	1695.065
48	23.5			1.507	1695.068
49	24			1.504	1695.071
50	24.5			1.500	1695.075
51	25			1.497	1695.078
52	25.5			1.493	1695.082
53	26			1.489	1695.086
54	26.5			1.484	1695.091
55	27			1.479	1695.096
56	27.5			1.475	1695.100
57	28			1.471	1695.104
58	28.5			1.466	1695.109
59	29			1.461	1695.114
60	29.5			1.454	1695.121
61	30			1.446	1695.129
62	30.5			1.439	1695.136
63	31			1.432	1695.143
64	31.5			1.427	1695.148
65	32			1.422	1695.153
66	32.5			1.418	1695.157
67	33			1.413	1695.162
68	33.5			1.410	1695.165
69	34			1.407	1695.168
70	34.5			1.405	1695.170
71	35			1.403	1695.172
72	35.5			1.399	1695.176
73	36			1.395	1695.180
74	36.5			1.389	1695.186
75	37			1.382	1695.193
76	37.5			1.374	1695.201
77	38			1.367	1695.208
78	38.5			1.360	1695.215
79	39			1.354	1695.221
80	39.5			1.348	1695.227

N°	PUNTO	V.AT	AL.INS	V.AD	COTA
81	40			1.341	1695.234
82	40.5			1.334	1695.241
83	41			1.326	1695.249
84	41.5			1.318	1695.257
85	42			1.309	1695.266
86	42.5			1.302	1695.273
87	43			1.296	1695.279
88	43.5			1.289	1695.286
89	44			1.282	1695.293
90	44.5			1.277	1695.298
91	45			1.271	1695.304
92	45.5			1.263	1695.312
93	46			1.255	1695.320
94	46.5			1.248	1695.327
95	47			1.241	1695.334
96	47.5			1.233	1695.342
97	48			1.226	1695.349
98	48.5			1.219	1695.356
99	49			1.212	1695.363
100	49.5			1.204	1695.371
101	50			1.197	1695.378
102	50.5			1.188	1695.387
103	51			1.180	1695.395
104	51.5			1.174	1695.401
105	52			1.168	1695.407
106	52.5			1.161	1695.414
107	53			1.155	1695.420
108	53.5			1.138	1695.437
109	54			1.121	1695.454
110	54.5			1.113	1695.462
111	55			1.105	1695.470
112	55.5			1.099	1695.476
113	56			1.092	1695.483
114	56.5			1.086	1695.489
115	57			1.079	1695.496
116	57.5			1.073	1695.502
117	58			1.067	1695.508
118	58.5			1.060	1695.515
119	59			1.054	1695.521
120	59.5			1.048	1695.527
121	60			1.042	1695.533
122	60.5			1.035	1695.540
123	61			1.028	1695.547
124	61.5			1.074	1695.501
125	62			1.012	1695.563
126	62.5			1.006	1695.569
127	63			1.000	1695.575
128	63.5			0.991	1695.584
129	64			0.983	1695.592
130	64.5			0.974	1695.601

N°	PUNTO	V.AT	AL.INS	V.AD	COTA
131	65			0.964	1695.611
132	65.5			0.956	1695.619
133	66			0.948	1695.627
134	66.5			0.942	1695.633
135	67			0.935	1695.640
136	67.5			0.928	1695.647
137	68			0.921	1695.654
138	68.5			0.911	1695.664
139	69			0.902	1695.673
140	69.5			0.894	1695.681
141	70			0.886	1695.689
142	70.5			0.879	1695.696
143	71			0.872	1695.703
144	71.5			0.864	1695.711
145	72			0.856	1695.719
146	72.5			0.848	1695.727
147	73			0.841	1695.734
148	73.5			0.833	1695.742
149	74			0.825	1695.750
150	74.5			0.817	1695.758
151	75			0.808	1695.767
152	75.5			0.800	1695.775
153	76			0.791	1695.784
154	76.5			0.783	1695.792
155	77			0.775	1695.800
156	77.5			0.766	1695.809
157	78			0.757	1695.818
158	78.5			0.750	1695.825
159	79			0.743	1695.832
160	79.5			0.736	1695.839
161	80			0.730	1695.845
162	80.5			0.722	1695.853
163	81			0.714	1695.861
164	81.5			0.706	1695.869
165	82			0.697	1695.878
166	82.5			0.691	1695.884
167	83			0.684	1695.891
168	83.5			0.678	1695.897
169	84			0.673	1695.902
170	84.5			0.665	1695.910
171	85			0.658	1695.917
172	85.5			0.655	1695.920
173	86			0.653	1695.922
174	86.5			0.649	1695.926
175	87			0.645	1695.930
176	87.5			0.640	1695.935
177	88			0.635	1695.940
178	88.5			0.631	1695.944
179	89			0.627	1695.948
180	89.5			0.625	1695.950

N°	PUNTO	V.AT	AL.INS	V.AD	COTA
181	90			0.623	1695.952
182	90.5			0.614	1695.961
183	91			0.606	1695.969
184	91.5			0.600	1695.975
185	92			0.594	1695.981
186	92.5			0.587	1695.988
187	93			0.579	1695.996
188	93.5			0.570	1696.005
189	94			0.560	1696.015
190	94.5			0.547	1696.028
191	95			0.534	1696.041
192	95.5			0.520	1696.055
193	96			0.506	1696.069
194	96.5			0.493	1696.082
195	97			0.481	1696.094
196	97.5			0.469	1696.106
197	98			0.457	1696.118
198	98.5			0.440	1696.135
199	99			0.423	1696.152
200	99.5			0.408	1696.167
201	100			0.392	1696.183

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Ing. Chambi Gareca Pablo

**RESPONSABLE DEL LABORATORIA DE  
TOPOGRAFÍA**

**FACULTAD DE CIENCIAS Y TEGNOLOGÍA**

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Univ. Ramos Quispe Alejandra

**ESTUDIANTE CIV 502**

**FACULTAD DE CIENCIAS Y TEGNOLOGÍA**

**Código del tramo: 05**

**Longitud del Tramo: 100 metros.**

**Nombre del tramo: Ruta Nacional 1 (Cruce Calamuchita – Entrada a Muturayo)**

**Abscisa del tramo inicial: 0 m.**

**Abscisa del tramo final: 100 m.**

**Carril de ida**

**Huella 2**

N°	PUNTO	V.AT	AL.INS	V.AD	COTA
1	0	1.611	1697.611		1696
2	0.5			1.608	1696.002
3	1			1.606	1696.005
4	1.5			1.605	1696.006
5	2			1.604	1696.007
6	2.5			1.604	1696.007
7	3			1.604	1696.007
8	3.5			1.605	1696.006
9	4			1.606	1696.005
10	4.5			1.604	1696.007
11	5			1.602	1696.009
12	5.5			1.601	1696.010
13	6			1.600	1696.011
14	6.5			1.600	1696.011
15	7			1.599	1696.012
16	7.5			1.598	1696.013
17	8			1.597	1696.014
18	8.5			1.594	1696.017
19	9			1.592	1696.019
20	9.5			1.591	1696.020
21	10			1.590	1696.021
22	10.5			1.588	1696.023
23	11			1.586	1696.025
24	11.5			1.585	1696.026
25	12			1.583	1696.027
26	12.5			1.581	1696.030
27	13			1.579	1696.032
28	13.5			1.578	1696.033
29	14			1.576	1696.035
30	14.5			1.574	1696.037
31	15			1.571	1696.039
32	15.5			1.568	1696.043
33	16			1.564	1696.047
34	16.5			1.561	1696.050
35	17			1.557	1696.054
36	17.5			1.554	1696.057
37	18			1.551	1696.060
38	18.5			1.548	1696.063
39	19			1.544	1696.067
40	19.5			1.541	1696.070

N°	PUNTO	V.AT	AL.INS	V.AD	COTA
41	20			1.538	1696.073
42	20.5			1.536	1696.075
43	21			1.533	1696.078
44	21.5			1.530	1696.081
45	22			1.527	1696.084
46	22.5			1.525	1696.086
47	23			1.523	1696.087
48	23.5			1.520	1696.090
49	24			1.518	1696.093
50	24.5			1.514	1696.096
51	25			1.511	1696.099
52	25.5			1.506	1696.105
53	26			1.500	1696.110
54	26.5			1.496	1696.115
55	27			1.491	1696.120
56	27.5			1.486	1696.124
57	28			1.482	1696.129
58	28.5			1.478	1696.133
59	29			1.474	1696.136
60	29.5			1.469	1696.142
61	30			1.463	1696.148
62	30.5			1.455	1696.155
63	31			1.448	1696.163
64	31.5			1.443	1696.168
65	32			1.438	1696.173
66	32.5			1.433	1696.177
67	33			1.429	1696.182
68	33.5			1.424	1696.186
69	34			1.419	1696.191
70	34.5			1.417	1696.193
71	35			1.415	1696.196
72	35.5			1.410	1696.201
73	36			1.405	1696.206
74	36.5			1.398	1696.213
75	37			1.391	1696.220
76	37.5			1.384	1696.227
77	38			1.377	1696.234
78	38.5			1.373	1696.237
79	39			1.370	1696.241
80	39.5			1.363	1696.248



N°	PUNTO	V.AT	AL.INS	V.AD	COTA
81	40			1.356	1696.255
82	40.5			1.347	1696.263
83	41			1.339	1696.272
84	41.5			1.328	1696.283
85	42			1.317	1696.293
86	42.5			1.310	1696.301
87	43			1.303	1696.308
88	43.5			1.296	1696.314
89	44			1.290	1696.321
90	44.5			1.284	1696.327
91	45			1.278	1696.333
92	45.5			1.269	1696.341
93	46			1.261	1696.350
94	46.5			1.254	1696.357
95	47			1.246	1696.365
96	47.5			1.239	1696.372
97	48			1.231	1696.379
98	48.5			1.224	1696.387
99	49			1.217	1696.394
100	49.5			1.209	1696.402
101	50			1.201	1696.410
102	50.5			1.191	1696.419
103	51			1.182	1696.428
104	51.5			1.176	1696.435
105	52			1.170	1696.441
106	52.5			1.155	1696.456
107	53			1.140	1696.470
108	53.5			1.129	1696.482
109	54			1.117	1696.494
110	54.5			1.109	1696.502
111	55			1.100	1696.511
112	55.5			1.094	1696.517
113	56			1.087	1696.524
114	56.5			1.079	1696.532
115	57			1.071	1696.540
116	57.5			1.063	1696.548
117	58			1.055	1696.556
118	58.5			1.047	1696.563
119	59			1.040	1696.571
120	59.5			1.033	1696.578
121	60			1.025	1696.585
122	60.5			1.019	1696.592
123	61			1.013	1696.598
124	61.5			1.005	1696.606
125	62			0.996	1696.615
126	62.5			0.988	1696.623
127	63			1.980	1695.631
128	63.5			0.972	1696.638
129	64			0.965	1696.646
130	64.5			0.954	1696.656

N°	PUNTO	V.AT	AL.INS	V.AD	COTA
131	65			0.944	1696.667
132	65.5			0.937	1696.674
133	66			0.930	1696.681
134	66.5			0.921	1696.690
135	67			0.912	1696.699
136	67.5			0.904	1696.707
137	68			0.896	1696.715
138	68.5			0.887	1696.724
139	69			0.878	1696.733
140	69.5			0.870	1696.741
141	70			0.862	1696.748
142	70.5			0.853	1696.758
143	71			0.844	1696.767
144	71.5			0.837	1696.774
145	72			0.830	1696.781
146	72.5			0.823	1696.788
147	73			0.816	1696.795
148	73.5			0.809	1696.802
149	74			0.801	1696.810
150	74.5			0.792	1696.819
151	75			0.783	1696.828
152	75.5			0.775	1696.836
153	76			0.768	1696.843
154	76.5			0.759	1696.852
155	77			0.750	1696.861
156	77.5			0.743	1696.868
157	78			0.736	1696.875
158	78.5			0.728	1696.883
159	79			0.719	1696.892
160	79.5			0.712	1696.899
161	80			0.704	1696.907
162	80.5			0.696	1696.915
163	81			0.687	1696.924
164	81.5			0.676	1696.934
165	82			0.666	1696.945
166	82.5			0.659	1696.952
167	83			0.652	1696.959
168	83.5			0.645	1696.966
169	84			0.637	1696.974
170	84.5			0.630	1696.981
171	85			0.623	1696.988
172	85.5			0.614	1696.997
173	86			0.605	1697.006
174	86.5			0.597	1697.013
175	87			0.590	1697.021
176	87.5			0.581	1697.030
177	88			0.572	1697.038
178	88.5			0.565	1697.046
179	89			0.557	1697.054
180	89.5			0.550	1697.061

N°	PUNTO	V.AT	AL.INS	V.AD	COTA
181	90			0.543	1697.068
182	90.5			0.540	1697.071
183	91			0.537	1697.073
184	91.5			0.527	1697.083
185	92			0.517	1697.093
186	92.5			0.511	1697.100
187	93			0.504	1697.107
188	93.5			0.499	1697.112
189	94			0.494	1697.117
190	94.5			0.483	1697.127
191	95			0.473	1697.138
192	95.5			0.462	1697.149
193	96			0.450	1697.161
194	96.5			0.440	1697.170
195	97			0.431	1697.180
196	97.5			0.418	1697.193
197	98			0.406	1697.205
198	98.5			0.395	1697.216
199	99			0.383	1697.227
200	99.5			0.368	1697.243
201	100			0.352	1697.259

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 Ing. Chambi Gareca Pablo

**RESPONSABLE DEL LABORATORIA DE  
 TOPOGRAFÍA**

**FACULTAD DE CIENCIAS Y TEGNOLOGÍA**

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 Univ. Ramos Quispe Alejandra

**ESTUDIANTE CIV 502**

**FACULTAD DE CIENCIAS Y TEGNOLOGÍA**

**Código del tramo: 05**

**Longitud del Tramo: 100 metros.**

**Nombre del tramo: Ruta Nacional 1 (Cruce Calamuchita – Entrada a Maturayo)**

**Abscisa del tramo inicial: 0 m.**

**Abscisa del tramo final: 100 m.**

**Carril de vuelta**

**Huella 1**

N°	PUNTO	V.AT	AL.INS	V.AD	COTA
1	0	1.575	1720.575		1719
2	0.5			1.574	1719.000
3	1			1.574	1719.001
4	1.5			1.572	1719.003
5	2			1.570	1719.005
6	2.5			1.570	1719.005
7	3			1.570	1719.004
8	3.5			1.570	1719.004
9	4			1.571	1719.004
10	4.5			1.570	1719.004
11	5			1.570	1719.005
12	5.5			1.569	1719.006
13	6			1.568	1719.007
14	6.5			1.569	1719.006
15	7			1.570	1719.005
16	7.5			1.570	1719.004
17	8			1.571	1719.004
18	8.5			1.568	1719.007
19	9			1.565	1719.010
20	9.5			1.563	1719.012
21	10			1.561	1719.014
22	10.5			1.561	1719.014
23	11			1.561	1719.014
24	11.5			1.559	1719.016
25	12			1.557	1719.018
26	12.5			1.556	1719.019
27	13			1.554	1719.020
28	13.5			1.553	1719.022
29	14			1.552	1719.023
30	14.5			1.549	1719.025
31	15			1.547	1719.028
32	15.5			1.546	1719.028
33	16			1.546	1719.029
34	16.5			1.541	1719.033
35	17			1.537	1719.038
36	17.5			1.535	1719.040
37	18			1.533	1719.041
38	18.5			1.531	1719.044
39	19			1.528	1719.047
40	19.5			1.526	1719.048

N°	PUNTO	V.AT	AL.INS	V.AD	COTA
41	20			1.525	1719.050
42	20.5			1.524	1719.051
43	21			1.523	1719.052
44	21.5			1.520	1719.055
45	22			1.517	1719.058
46	22.5			1.514	1719.061
47	23			1.511	1719.064
48	23.5			1.507	1719.067
49	24			1.504	1719.071
50	24.5			1.502	1719.073
51	25			1.499	1719.076
52	25.5			1.494	1719.080
53	26			1.490	1719.085
54	26.5			1.485	1719.090
55	27			1.480	1719.095
56	27.5			1.476	1719.098
57	28			1.473	1719.102
58	28.5			1.467	1719.108
59	29			1.461	1719.114
60	29.5			1.454	1719.121
61	30			1.447	1719.128
62	30.5			1.439	1719.135
63	31			1.432	1719.142
64	31.5			1.428	1719.147
65	32			1.423	1719.152
66	32.5			1.418	1719.157
67	33			1.413	1719.161
68	33.5			1.410	1719.164
69	34			1.408	1719.167
70	34.5			1.405	1719.169
71	35			1.403	1719.172
72	35.5			1.399	1719.175
73	36			1.396	1719.179
74	36.5			1.389	1719.186
75	37			1.382	1719.192
76	37.5			1.375	1719.200
77	38			1.367	1719.208
78	38.5			1.361	1719.214
79	39			1.354	1719.220
80	39.5			1.348	1719.227

N°	PUNTO	V.AT	AL.INS	V.AD	COTA
81	40			1.341	1719.233
82	40.5			1.334	1719.241
83	41			1.326	1719.248
84	41.5			1.319	1719.255
85	42			1.312	1719.263
86	42.5			1.304	1719.271
87	43			1.296	1719.279
88	43.5			1.289	1719.285
89	44			1.283	1719.292
90	44.5			1.277	1719.298
91	45			1.271	1719.304
92	45.5			1.264	1719.311
93	46			1.256	1719.319
94	46.5			1.249	1719.326
95	47			1.241	1719.334
96	47.5			1.234	1719.341
97	48			1.226	1719.348
98	48.5			1.219	1719.355
99	49			1.212	1719.362
100	49.5			1.205	1719.370
101	50			1.197	1719.378
102	50.5			1.189	1719.386
103	51			1.180	1719.394
104	51.5			1.174	1719.400
105	52			1.168	1719.406
106	52.5			1.162	1719.413
107	53			1.155	1719.420
108	53.5			1.128	1719.447
109	54			1.121	1719.454
110	54.5			1.113	1719.462
111	55			1.105	1719.470
112	55.5			1.099	1719.476
113	56			1.093	1719.482
114	56.5			1.086	1719.489
115	57			1.079	1719.495
116	57.5			1.073	1719.502
117	58			1.067	1719.508
118	58.5			1.061	1719.514
119	59			1.054	1719.521
120	59.5			1.048	1719.527
121	60			1.042	1719.533
122	60.5			1.035	1719.540
123	61			1.028	1719.546
124	61.5			1.021	1719.554
125	62			1.013	1719.562
126	62.5			1.007	1719.568
127	63			1.000	1719.574
128	63.5			0.992	1719.583
129	64			0.983	1719.592
130	64.5			0.974	1719.601

N°	PUNTO	V.AT	AL.INS	V.AD	COTA
131	65			0.965	1719.610
132	65.5			0.957	1719.618
133	66			0.949	1719.626
134	66.5			0.942	1719.633
135	67			0.935	1719.640
136	67.5			0.928	1719.647
137	68			0.921	1719.654
138	68.5			0.912	1719.663
139	69			0.902	1719.673
140	69.5			0.894	1719.681
141	70			0.886	1719.688
142	70.5			0.879	1719.696
143	71			0.872	1719.703
144	71.5			0.864	1719.711
145	72			0.856	1719.719
146	72.5			0.848	1719.726
147	73			0.841	1719.734
148	73.5			0.833	1719.741
149	74			0.826	1719.749
150	74.5			0.817	1719.758
151	75			0.808	1719.766
152	75.5			0.800	1719.775
153	76			0.792	1719.783
154	76.5			0.783	1719.792
155	77			0.775	1719.800
156	77.5			0.766	1719.809
157	78			0.757	1719.817
158	78.5			0.750	1719.824
159	79			0.743	1719.831
160	79.5			0.737	1719.838
161	80			0.730	1719.844
162	80.5			0.723	1719.851
163	81			0.716	1719.859
164	81.5			0.707	1719.868
165	82			0.697	1719.877
166	82.5			0.692	1719.882
167	83			0.687	1719.888
168	83.5			0.680	1719.895
169	84			0.673	1719.902
170	84.5			0.665	1719.909
171	85			0.658	1719.917
172	85.5			0.656	1719.919
173	86			0.654	1719.921
174	86.5			0.649	1719.925
175	87			0.645	1719.929
176	87.5			0.642	1719.933
177	88			0.638	1719.937
178	88.5			0.633	1719.942
179	89			0.627	1719.947
180	89.5			0.625	1719.949

N°	PUNTO	V.AT	AL.INS	V.AD	COTA
181	90			0.623	1719.952
182	90.5			0.614	1719.960
183	91			0.606	1719.969
184	91.5			0.600	1719.975
185	92			0.594	1719.980
186	92.5			0.587	1719.988
187	93			0.579	1719.995
188	93.5			0.570	1720.005
189	94			0.561	1720.014
190	94.5			0.548	1720.027
191	95			0.534	1720.040
192	95.5			0.520	1720.055
193	96			0.506	1720.069
194	96.5			0.493	1720.081
195	97			0.481	1720.094
196	97.5			0.469	1720.106
197	98			0.457	1720.118
198	98.5			0.440	1720.134
199	99			0.424	1720.151
200	99.5			0.408	1720.167
201	100			0.393	1720.182

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Ing. Chambi Gareca Pablo  
**RESPONSABLE DEL LABORATORIA DE  
TOPOGRAFÍA**  
**FACULTAD DE CIENCIAS Y TEGNOLOGÍA**

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Univ. Ramos Quispe Alejandra  
**ESTUDIANTE CIV 502**  
**FACULTAD DE CIENCIAS Y TEGNOLOGÍA**

**Código del tramo: 05**

**Longitud del Tramo: 100 metros.**

**Nombre del tramo: Ruta Nacional 1 (Cruce Calamuchita – Entrada a Muturayo)**

**Abscisa del tramo inicial: 0 m.**

**Abscisa del tramo final: 100 m.**

**Carril de vuelta**

**Huella 2**

N°	PUNTO	V.AT	AL.INS	V.AD	COTA
1	0	1.610	1721.610		1720
2	0.5			1.608	1720.002
3	1			1.606	1720.004
4	1.5			1.605	1720.005
5	2			1.604	1720.006
6	2.5			1.604	1720.006
7	3			1.604	1720.006
8	3.5			1.605	1720.005
9	4			1.606	1720.004
10	4.5			1.604	1720.006
11	5			1.603	1720.008
12	5.5			1.602	1720.009
13	6			1.600	1720.010
14	6.5			1.600	1720.010
15	7			1.599	1720.011
16	7.5			1.598	1720.012
17	8			1.597	1720.014
18	8.5			1.595	1720.016
19	9			1.592	1720.018
20	9.5			1.591	1720.019
21	10			1.590	1720.020
22	10.5			1.588	1720.022
23	11			1.586	1720.024
24	11.5			1.585	1720.025
25	12			1.583	1720.027
26	12.5			1.583	1720.027
27	13			1.583	1720.027
28	13.5			1.581	1720.029
29	14			1.579	1720.031
30	14.5			1.575	1720.035
31	15			1.572	1720.039
32	15.5			1.568	1720.042
33	16			1.565	1720.046
34	16.5			1.563	1720.047
35	17			1.561	1720.049
36	17.5			1.556	1720.054
37	18			1.551	1720.059
38	18.5			1.548	1720.062
39	19			1.545	1720.065
40	19.5			1.542	1720.068

N°	PUNTO	V.AT	AL.INS	V.AD	COTA
41	20			1.539	1720.072
42	20.5			1.536	1720.074
43	21			1.533	1720.077
44	21.5			1.530	1720.080
45	22			1.527	1720.083
46	22.5			1.525	1720.085
47	23			1.524	1720.087
48	23.5			1.521	1720.090
49	24			1.518	1720.093
50	24.5			1.515	1720.096
51	25			1.512	1720.099
52	25.5			1.506	1720.104
53	26			1.501	1720.110
54	26.5			1.496	1720.115
55	27			1.491	1720.119
56	27.5			1.488	1720.122
57	28			1.485	1720.125
58	28.5			1.480	1720.130
59	29			1.475	1720.136
60	29.5			1.469	1720.142
61	30			1.463	1720.147
62	30.5			1.456	1720.155
63	31			1.448	1720.162
64	31.5			1.443	1720.167
65	32			1.438	1720.172
66	32.5			1.434	1720.177
67	33			1.429	1720.181
68	33.5			1.425	1720.186
69	34			1.420	1720.191
70	34.5			1.418	1720.193
71	35			1.415	1720.195
72	35.5			1.410	1720.200
73	36			1.405	1720.205
74	36.5			1.398	1720.212
75	37			1.392	1720.219
76	37.5			1.384	1720.226
77	38			1.377	1720.233
78	38.5			1.374	1720.237
79	39			1.370	1720.240
80	39.5			1.363	1720.247

N°	PUNTO	V.AT	AL.INS	V.AD	COTA
81	40			1.356	1720.254
82	40.5			1.348	1720.263
83	41			1.339	1720.271
84	41.5			1.328	1720.282
85	42			1.318	1720.293
86	42.5			1.310	1720.300
87	43			1.303	1720.307
88	43.5			1.297	1720.314
89	44			1.290	1720.320
90	44.5			1.284	1720.326
91	45			1.278	1720.332
92	45.5			1.270	1720.340
93	46			1.262	1720.348
94	46.5			1.254	1720.356
95	47			1.247	1720.364
96	47.5			1.239	1720.371
97	48			1.232	1720.379
98	48.5			1.224	1720.386
99	49			1.217	1720.393
100	49.5			1.209	1720.401
101	50			1.201	1720.409
102	50.5			1.197	1720.413
103	51			1.183	1720.428
104	51.5			1.176	1720.434
105	52			1.170	1720.440
106	52.5			1.155	1720.455
107	53			1.141	1720.470
108	53.5			1.129	1720.482
109	54			1.117	1720.493
110	54.5			1.109	1720.502
111	55			1.100	1720.510
112	55.5			1.095	1720.516
113	56			1.089	1720.521
114	56.5			1.080	1720.530
115	57			1.071	1720.539
116	57.5			1.063	1720.547
117	58			1.055	1720.555
118	58.5			1.048	1720.563
119	59			1.040	1720.570
120	59.5			1.033	1720.577
121	60			1.026	1720.585
122	60.5			1.019	1720.591
123	61			1.013	1720.597
124	61.5			1.005	1720.606
125	62			0.997	1720.614
126	62.5			0.988	1720.622
127	63			1.980	1719.630
128	63.5			0.973	1720.638
129	64			0.965	1720.645
130	64.5			0.956	1720.654

N°	PUNTO	V.AT	AL.INS	V.AD	COTA
131	65			0.947	1720.663
132	65.5			0.939	1720.672
133	66			0.930	1720.680
134	66.5			0.921	1720.689
135	67			0.912	1720.698
136	67.5			0.904	1720.706
137	68			0.896	1720.714
138	68.5			0.887	1720.723
139	69			0.878	1720.732
140	69.5			0.870	1720.740
141	70			0.863	1720.748
142	70.5			0.854	1720.756
143	71			0.845	1720.765
144	71.5			0.838	1720.773
145	72			0.830	1720.780
146	72.5			0.824	1720.786
147	73			0.818	1720.792
148	73.5			0.810	1720.801
149	74			0.801	1720.809
150	74.5			0.792	1720.818
151	75			0.783	1720.827
152	75.5			0.776	1720.835
153	76			0.768	1720.842
154	76.5			0.759	1720.851
155	77			0.750	1720.860
156	77.5			0.743	1720.867
157	78			0.736	1720.874
158	78.5			0.729	1720.881
159	79			0.722	1720.888
160	79.5			0.713	1720.897
161	80			0.704	1720.906
162	80.5			0.696	1720.914
163	81			0.687	1720.923
164	81.5			0.677	1720.934
165	82			0.666	1720.944
166	82.5			0.659	1720.951
167	83			0.652	1720.958
168	83.5			0.645	1720.965
169	84			0.637	1720.973
170	84.5			0.630	1720.980
171	85			0.623	1720.987
172	85.5			0.615	1720.995
173	86			0.607	1721.003
174	86.5			0.598	1721.012
175	87			0.590	1721.020
176	87.5			0.581	1721.029
177	88			0.573	1721.038
178	88.5			0.565	1721.046
179	89			0.557	1721.053
180	89.5			0.550	1721.060

N°	PUNTO	V.AT	AL.INS	V.AD	COTA
181	90			0.543	1721.067
182	90.5			0.540	1721.070
183	91			0.538	1721.073
184	91.5			0.528	1721.083
185	92			0.518	1721.093
186	92.5			0.511	1721.100
187	93			0.504	1721.106
188	93.5			0.499	1721.111
189	94			0.494	1721.116
190	94.5			0.484	1721.127
191	95			0.473	1721.137
192	95.5			0.462	1721.148
193	96			0.450	1721.160
194	96.5			0.441	1721.170
195	97			0.431	1721.179
196	97.5			0.418	1721.192
197	98			0.406	1721.204
198	98.5			0.395	1721.215
199	99			0.384	1721.227
200	99.5			0.368	1721.242
201	100			0.353	1721.258

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 Ing. Chambi Gareca Pablo

**RESPONSABLE DEL LABORATORIA DE  
 TOPOGRAFÍA**

**FACULTAD DE CIENCIAS Y TEGNOLOGÍA**

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 Univ. Ramos Quispe Alejandra

**ESTUDIANTE CIV 502**

**FACULTAD DE CIENCIAS Y TEGNOLOGÍA**



## RESULTADOS OBTENIDOS

<b>TRAMO RURAL</b>	<b>IRI NIVEL DE INGENIERO (m/km)</b>	
	<b>CARRIL DE IDA</b>	
	<b>HUELLA EXTERIOR</b>	<b>HUELLA INTERIOR</b>
El Portillo -La Pintada (Cruce Ruta 11 Villamontes - Entrada al proyecto múltiples san jacinto - oficinas)	3.393	3.523
Carretera San Mateo – Sella (Monte Méndez - Barrio El Taco)	2.817	2.423
Ruta Nacional 1 (Cruce Calamuchita – Entrada a Muturayo)	3.997	3.322

<b>TRAMO RURAL</b>	<b>IRI NIVEL DE INGENIERO (m/km)</b>	
	<b>CARRIL DE VUELTA</b>	
	<b>HUELLA EXTERIOR</b>	<b>HUELLA INTERIOR</b>
El Portillo -La Pintada (Cruce Ruta 11 Villamontes - Entrada al proyecto múltiples san jacinto - oficinas)	4.142	2.635
Carretera San Mateo – Sella (Monte Méndez - Barrio El Taco)	2.767	2.713
Ruta Nacional 1 (Cruce Calamuchita – Entrada a Muturayo)	3.128	3.107

<b>TRAMO RURAL</b>	<b>MEDIA MIRA Y NIVEL DE INGENIERO</b>	
	<b>IDA</b>	<b>VUELTA</b>
El Portillo -La Pintada (Cruce Ruta 11 Villamontes - Entrada al proyecto múltiples san jacinto - oficinas)	3.46	3.39
Carretera San Mateo – Sella (Monte Méndez - Barrio El Taco)	2.62	2.74
Ruta Nacional 1 (Cruce Calamuchita – Entrada a Muturayo)	3.66	3.12



**UNIVERSIDAD AUTÓNOMA JUAN MISAEL SARACHO**  
**FACULTAD CIENCIAS Y TECNOLOGÍA**  
**DPTO. DE TOPOGRAFIA Y VÍAS DE COMUNICACIÓN**  
**CARRERA DE INGENIERIA CIVIL**  
**LABORATORIO DE ASFALTOS**

**ANEXO C**

**DATOS Y CÁLCULO DE IRI ZONA URBANA**  
**DISPOSITIVO DE MERLÍN**



UNIVERSIDAD AUTÓNOMA JUAN MISAEL SARACHO  
FACULTAD CIENCIAS Y TECNOLOGÍA  
DPTO. DE TOPOGRAFIA Y VÍAS DE COMUNICACIÓN  
CARRERA DE INGENIERIA CIVIL  
LABORATORIO DE ASFALTOS

**“EVALUACIÓN DE METODOLOGÍAS PARA DETERMINAR EL IRI EN PAVIMENTOS FLEXIBLES Y LA INFLUENCIA EN EL NIVEL DE SERVICIO”**

**Nombre del laboratorista/tesista:** Alejandra Ramos Quispe

**Fecha de realización del ensayo:** 24-09-2022

**Número de muestra:** 1

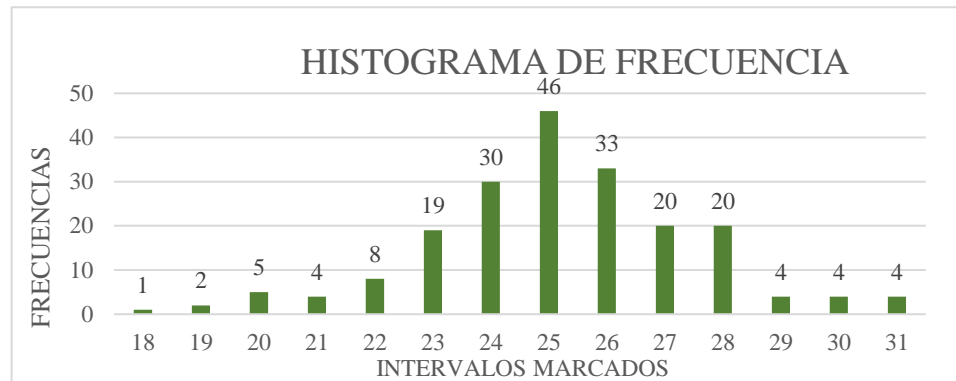
**Nombre del tramo:** Av. Jesús Molina (Cruce ruta San Jacinto - Casa del Mariachi)

**Carril de ida** Progresiva: 0+000 a 0+400

**Huella 1**

	1	2	3	4	5	6	7	8	9	10
1	27.00	23.00	25.00	28.00	26.00	25.00	26.00	25.00	22.00	27.00
2	26.00	24.00	27.00	24.00	25.00	25.00	24.00	22.00	24.00	28.00
3	23.00	28.00	26.00	26.00	30.00	24.00	25.00	23.00	28.00	29.00
4	23.00	28.00	28.00	24.00	24.00	27.00	23.00	23.00	25.00	20.00
5	24.00	28.00	25.00	25.00	25.00	26.00	26.00	27.00	24.00	26.00
6	28.00	27.00	24.00	25.00	24.00	26.00	25.00	22.00	25.00	26.00
7	22.00	23.00	27.00	25.00	25.00	25.00	19.00	26.00	24.00	30.00
8	23.00	26.00	25.00	25.00	21.00	26.00	23.00	25.00	25.00	25.00
9	25.00	31.00	20.00	25.00	26.00	25.00	25.00	25.00	27.00	27.00
10	31.00	23.00	24.00	24.00	26.00	23.00	31.00	26.00	31.00	28.00
11	25.00	26.00	26.00	27.00	25.00	24.00	27.00	23.00	27.00	27.00
12	27.00	23.00	25.00	25.00	23.00	26.00	22.00	18.00	24.00	24.00
13	21.00	26.00	24.00	30.00	25.00	25.00	23.00	30.00	25.00	28.00
14	28.00	27.00	29.00	26.00	23.00	23.00	26.00	25.00	24.00	29.00
15	26.00	25.00	26.00	24.00	26.00	26.00	27.00	28.00	24.00	27.00
16	25.00	25.00	24.00	28.00	26.00	24.00	28.00	27.00	24.00	28.00
17	22.00	25.00	24.00	21.00	28.00	25.00	24.00	28.00	19.00	25.00
18	27.00	25.00	22.00	24.00	25.00	26.00	27.00	20.00	20.00	29.00
19	25.00	25.00	24.00	28.00	26.00	26.00	28.00	25.00	24.00	25.00
20	22.00	23.00	21.00	26.00	24.00	28.00	23.00	26.00	26.00	20.00

**HISTOGRAMA DE LO DATOS RECOLECTADOS**





**CALCULO DEL RANGO "D"**

Se depuran un total de 10% de los datos siendo 5% por cada extremo del histograma

<b>Lado izquierdo</b>	
Valor a dividir (di) =	<b>4</b>
Existente (ei) =	8
Faltante (fi) =	<b>2</b>

<b>Lado derecho</b>	
Valor a dividir (dd) =	<b>4</b>
Existente (ed) =	8
Faltante (fd) =	<b>2</b>

N° de intervalos

Rango medio (dm) = **7**

Entonces "D" viene a ser:

$$D = \left( \frac{(d_i - f_i)}{d_i} + d_m + \frac{(d_d - f_d)}{d_d} \right) * 5 [mm]$$

D = 40 mm

**CÁLCULO FACTOR DE CORRECCIÓN fc:**

Donde:

- Ep = 6.2
- Li = 25
- Lf = 15

$$f_c = \left( \frac{(E_p * 10)}{(L_i - L_f) * 5} \right)$$

fc = 1.24 mm

**CÁLCULO DEL RANGO CORREGIDO Dc:**

$$D_c = D * f_c$$

Dc = 49.6 mm

**DETERMINACIÓN DEL I.R.I.:**

Para pavimentos nuevos:

I. R. I. = 0.0485 \* D<sub>c</sub>

—————> (IRI < 2.4)

Para pavimentos en servicio:

I. R. I. = 0.593 + 0.0471 \* D<sub>c</sub>

—————> (2.4 < IRI < 15.9)

**CÁLCULO DEL I.R.I.:**

Aplicando la fórmula para pavimentos en servicio:

I. R. I. = 0.593 + 0.0471 \* D<sub>c</sub>

**I.R.I. = 2.93 m/km**



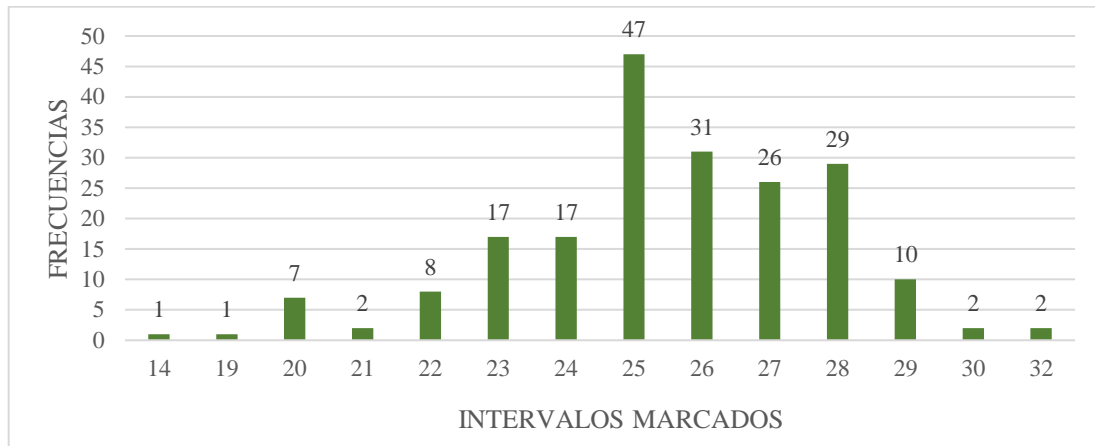
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**FACULTAD CIENCIAS Y TECNOLOGÍA**  
**DPTO. DE TOPOGRAFIA Y VÍAS DE COMUNICACIÓN**  
**CARRERA DE INGENIERIA CIVIL**  
**LABORATORIO DE ASFALTOS**

**Nombre del tramo:** Av. Jesús Molina (Cruce ruta San Jacinto - Casa del Mariachi)

**Carril exterior de ida** Progresiva: 0+400 a 0+800

	1	2	3	4	5	6	7	8	9	10
1	27.00	24.00	23.00	14.00	25.00	26.00	22.00	23.00	24.00	30.00
2	27.00	21.00	21.00	23.00	27.00	22.00	28.00	24.00	25.00	28.00
3	22.00	28.00	28.00	32.00	25.00	28.00	28.00	25.00	23.00	26.00
4	26.00	29.00	27.00	25.00	27.00	25.00	26.00	26.00	25.00	26.00
5	28.00	25.00	26.00	22.00	23.00	27.00	26.00	25.00	26.00	25.00
6	25.00	25.00	23.00	23.00	23.00	23.00	28.00	22.00	25.00	26.00
7	26.00	29.00	26.00	26.00	28.00	24.00	26.00	24.00	24.00	28.00
8	25.00	27.00	22.00	29.00	29.00	25.00	28.00	26.00	26.00	28.00
9	27.00	27.00	25.00	26.00	25.00	23.00	25.00	28.00	25.00	25.00
10	23.00	20.00	25.00	26.00	20.00	28.00	23.00	27.00	26.00	27.00
11	24.00	26.00	25.00	27.00	29.00	25.00	24.00	27.00	27.00	28.00
12	25.00	27.00	24.00	25.00	29.00	20.00	24.00	25.00	22.00	29.00
13	25.00	26.00	25.00	25.00	26.00	22.00	27.00	25.00	30.00	27.00
14	26.00	20.00	28.00	25.00	27.00	28.00	24.00	28.00	25.00	27.00
15	25.00	25.00	23.00	25.00	26.00	28.00	23.00	28.00	25.00	25.00
16	23.00	25.00	24.00	26.00	25.00	23.00	24.00	25.00	27.00	24.00
17	24.00	25.00	27.00	28.00	28.00	20.00	26.00	27.00	29.00	20.00
18	28.00	27.00	26.00	29.00	29.00	25.00	27.00	19.00	27.00	20.00
19	28.00	24.00	26.00	25.00	32.00	25.00	26.00	25.00	28.00	28.00
20	25.00	28.00	26.00	23.00	25.00	28.00	28.00	24.00	26.00	27.00

**HISTOGRAMA DE LO DATOS RECOLECTADOS**





**CALCULO DEL RANGO "D"**

Se depuran un total de 10% de los datos siendo 5% por cada extremo del histograma

<b>Lado izquierdo</b>	
Valor a dividir (di) =	<b>2</b>
Existente (ei) =	9
Faltante (fi) =	<b>1</b>

<b>Lado derecho</b>	
Valor a dividir (dd) =	<b>10</b>
Existente (ed) =	4
Faltante (fd) =	<b>6</b>

N° de intervalos

Rango medio (dm) = **7**

Entonces "D" viene a ser:

$$D = \left( \frac{(d_i - f_i)}{d_i} + d_m + \frac{(d_a - f_a)}{d_a} \right) * 5 [mm]$$

D = 39.5 mm

**CÁLCULO FACTOR DE CORRECCIÓN fc:**

Donde:

Ep = 6.2

Li = 25

Lf = 15

$$f_c = \left( \frac{(E_p * 10)}{(L_i - L_f) * 5} \right)$$

fc = 1.24 mm

**CÁLCULO DEL RANGO CORREGIDO Dc:**

$$D_c = D * f_c$$

Dc = 48.98 mm

**DETERMINACIÓN DEL I.R.I.:**

Para pavimentos nuevos:

I. R. I. = 0.0485 \* D<sub>c</sub>

→ (IRI < 2.4)

Para pavimentos en servicio:

I. R. I. = 0.593 + 0.0471 \* D<sub>c</sub>

→ (2.4 < IRI < 15.9)

**CÁLCULO DEL I.R.I.:**

Aplicando la fórmula para pavimentos en servicio:

I. R. I. = 0.593 + 0.0471 \* D<sub>c</sub>

**I.R.I. = 2.90 m/km**



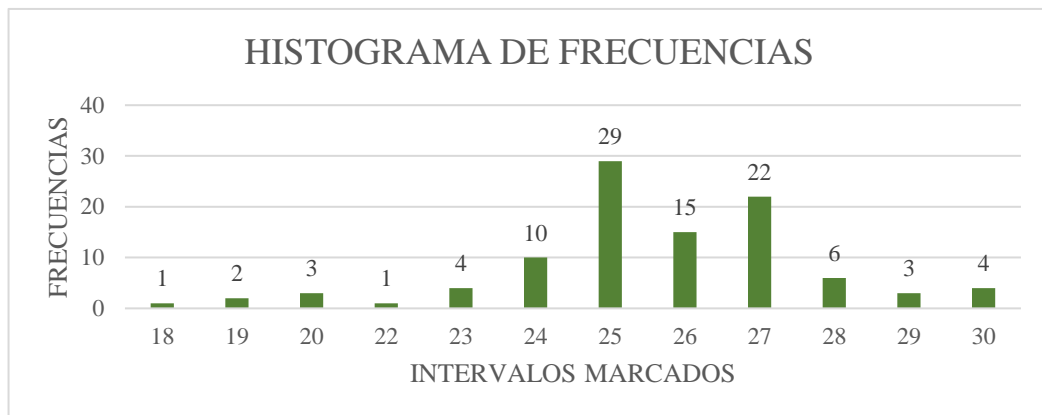
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**CARRERA DE INGENIERIA CIVIL**  
**LABORATORIO DE ASFALTOS**

**Nombre del tramo:** Av. Jesús Molina (Cruce ruta San Jacinto - Casa del Mariachi)

**Carril exterior de ida** Progresiva: 0+800 a 1+000

	1	2	3	4	5	6	7	8	9	10
1	27.00	25.00	27.00	24.00	26.00	24.00	27.00	27.00	27.00	25.00
2	27.00	29.00	25.00	28.00	25.00	22.00	27.00	30.00	25.00	24.00
3	27.00	30.00	25.00	26.00	25.00	26.00	22.00	20.00	23.00	26.00
4	24.00	26.00	29.00	27.00	26.00	20.00	27.00	25.00	26.00	26.00
5	26.00	30.00	24.00	30.00	25.00	28.00	30.00	23.00	25.00	25.00
6	25.00	26.00	25.00	18.00	27.00	28.00	25.00	28.00	24.00	26.00
7	27.00	27.00	27.00	22.00	25.00	23.00	26.00	24.00	26.00	28.00
8	26.00	23.00	25.00	28.00	26.00	26.00	25.00	26.00	25.00	27.00
9	27.00	24.00	23.00	25.00	25.00	28.00	26.00	27.00	24.00	28.00
10	19.00	24.00	27.00	28.00	28.00	25.00	28.00	26.00	26.00	27.00
11	25.00	27.00	20.00	23.00	25.00	22.00	27.00	23.00	25.00	28.00
12	29.00	24.00	20.00	30.00	27.00	23.00	26.00	25.00	29.00	27.00
13	26.00	26.00	28.00	24.00	25.00	24.00	24.00	25.00	27.00	28.00
14	27.00	26.00	25.00	20.00	27.00	23.00	26.00	22.00	27.00	25.00
15	25.00	25.00	23.00	25.00	27.00	26.00	25.00	25.00	25.00	26.00
16	27.00	25.00	28.00	27.00	27.00	26.00	25.00	28.00	25.00	28.00
17	25.00	27.00	24.00	25.00	25.00	26.00	27.00	23.00	28.00	23.00
18	25.00	25.00	19.00	25.00	27.00	22.00	25.00	24.00	27.00	26.00
19	26.00	24.00	26.00	25.00	25.00	25.00	26.00	26.00	26.00	25.00
20	27.00	25.00	26.00	26.00	24.00	24.00	25.00	27.00	25.00	26.00

**HISTOGRAMA DE LO DATOS RECOLECTADOS**





**CALCULO DEL RANGO "D"**

Se depuran un total de 10% de los datos siendo 5% por cada extremo del histograma

Lado izquierdo	
Valor a dividir (di) =	<b>4</b>
Existente (ei) =	7
Faltante (fi) =	<b>3</b>

Lado derecho	
Valor a dividir (dd) =	<b>6</b>
Existente (ed) =	7
Faltante (fd) =	<b>3</b>

N° de intervalos

Rango medio (dm) = **4**

Entonces "D" viene a ser:

$$D = \left( \frac{(d_i - f_i)}{d_i} + d_m + \frac{(d_d - f_d)}{d_d} \right) * 5 [mm]$$

D = 23.75 mm

**CÁLCULO FACTOR DE CORRECCIÓN fc:**

Donde:

Ep = 6.2  
 Li = 25  
 Lf = 15

$$f_c = \left( \frac{(E_p * 10)}{(L_i - L_f) * 5} \right)$$

fc = 1.24 mm

**CÁLCULO DEL RANGO CORREGIDO Dc:**

$$D_c = D * f_c$$

Dc = 29.45 mm

**DETERMINACIÓN DEL I.R.I.:**

Para pavimentos nuevos:

I. R. I. = 0.0485 \* D<sub>c</sub>

→ (IRI < 2.4)

Para pavimentos en servicio:

I. R. I. = 0.593 + 0.0471 \* D<sub>c</sub>

→ (2.4 < IRI < 15.9)

**CÁLCULO DEL I.R.I.:**

Aplicando la fórmula para pavimentos en servicio:

I. R. I. = 0.593 + 0.0471 \* D<sub>c</sub>

**I.R.I. = 1.98 m/km**





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LABORATORIO DE ASFALTOS

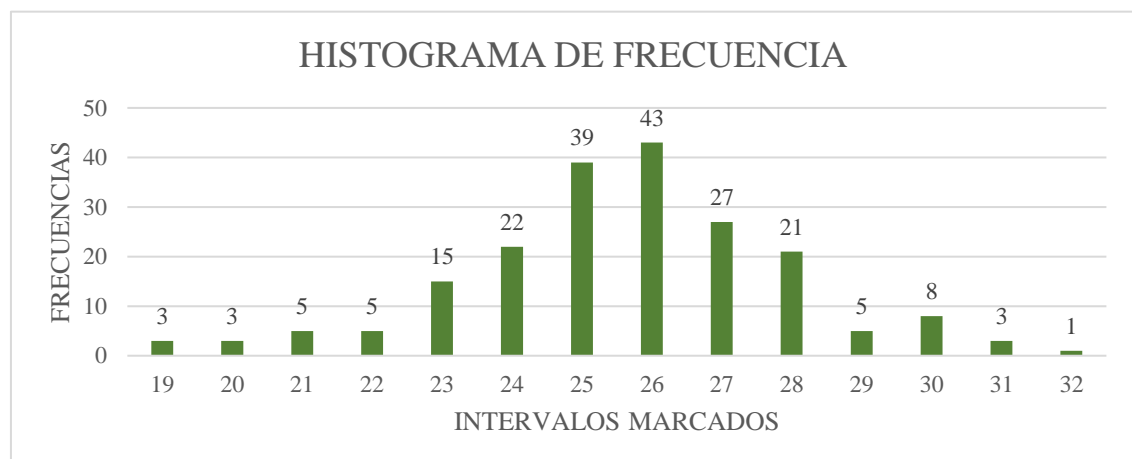
Nombre del tramo: Av. Jesús Molina (Cruce ruta San Jacinto - Casa del Mariachi)

Carril de ida Progresiva: 0+000 a 0+400

Huella 2

	1	2	3	4	5	6	7	8	9	10
1	28.00	24.00	26.00	27.00	27.00	26.00	27.00	27.00	23.00	27.00
2	26.00	25.00	27.00	24.00	25.00	26.00	25.00	23.00	25.00	26.00
3	24.00	28.00	27.00	26.00	30.00	25.00	25.00	22.00	28.00	30.00
4	24.00	28.00	28.00	25.00	25.00	27.00	24.00	22.00	26.00	21.00
5	23.00	28.00	26.00	26.00	26.00	26.00	26.00	27.00	24.00	26.00
6	29.00	28.00	25.00	26.00	25.00	26.00	25.00	24.00	25.00	26.00
7	23.00	24.00	27.00	26.00	25.00	25.00	20.00	26.00	25.00	31.00
8	24.00	27.00	26.00	26.00	21.00	27.00	24.00	25.00	25.00	27.00
9	25.00	30.00	21.00	26.00	26.00	25.00	25.00	25.00	28.00	26.00
10	32.00	24.00	25.00	25.00	25.00	23.00	30.00	26.00	30.00	29.00
11	26.00	27.00	26.00	28.00	25.00	23.00	27.00	24.00	28.00	28.00
12	28.00	24.00	25.00	26.00	24.00	26.00	23.00	19.00	23.00	25.00
13	22.00	26.00	25.00	31.00	25.00	26.00	23.00	31.00	25.00	29.00
14	28.00	28.00	30.00	25.00	23.00	24.00	27.00	24.00	23.00	30.00
15	27.00	26.00	26.00	25.00	27.00	26.00	28.00	27.00	24.00	27.00
16	25.00	26.00	24.00	29.00	27.00	25.00	28.00	27.00	25.00	28.00
17	23.00	26.00	24.00	22.00	29.00	26.00	25.00	28.00	19.00	26.00
18	28.00	26.00	23.00	25.00	26.00	27.00	28.00	21.00	21.00	30.00
19	26.00	26.00	25.00	20.00	25.00	27.00	27.00	26.00	23.00	24.00
20	22.00	24.00	20.00	27.00	24.00	28.00	23.00	26.00	27.00	19.00

HISTOGRAMA DE LO DATOS RECOLECTADOS





**CALCULO DEL RANGO "D"**

Se depuran un total de 10% de los datos siendo 5% por cada extremo del histograma

Lado izquierdo	
Valor a dividir (di) =	<b>5</b>
Existente (ei) =	<b>6</b>
Faltante (fi) =	<b>4</b>

Lado derecho	
Valor a dividir (dd) =	<b>8</b>
Existente (ed) =	<b>4</b>
Faltante (fd) =	<b>6</b>

N° de intervalos

Rango medio (dm) = **8**

Entonces "D" viene a ser:

$$D = \left( \frac{(d_i - f_i)}{d_i} + d_m + \frac{(d_d - f_d)}{d_d} \right) * 5 [mm]$$

D= 42.25 mm

**CÁLCULO FACTOR DE CORRECCIÓN fc:**

Donde:

- Ep = 6.2
- Li = 25
- Lf = 15

$$f_c = \left( \frac{(E_p * 10)}{(L_i - L_f) * 5} \right)$$

fc = 1.24 mm

**CÁLCULO DEL RANGO CORREGIDO Dc:**

$$D_c = D * f_c$$

Dc = 52.39 mm

**DETERMINACIÓN DEL I.R.I.:**

Para pavimentos nuevos:

$$I.R.I. = 0.0485 * D_c$$

→ (IRI < 2.4)

Para pavimentos en servicio:

$$I.R.I. = 0.593 + 0.0471 * D_c$$

→ (2.4 < IRI < 15.9)

**CÁLCULO DEL I.R.I.:**

Aplicando la fórmula para pavimentos en servicio:

$$I.R.I. = 0.593 + 0.0471 * D_c$$

I.R.I. = **3.06 m/km**



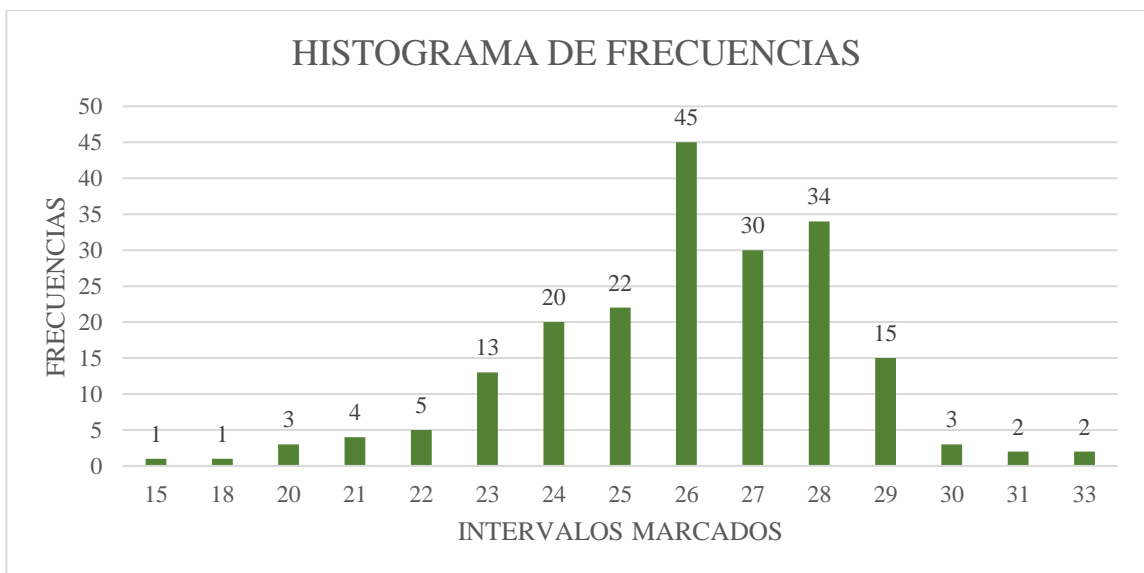
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**CARRERA DE INGENIERIA CIVIL**  
**LABORATORIO DE ASFALTOS**

**Nombre del tramo:** Av. Jesús Molina (Cruce ruta San Jacinto - Casa del Mariachi)

**Carril exterior de ida** Progresiva: 0+400 a 0+800

	1	2	3	4	5	6	7	8	9	10
1	28.00	25.00	24.00	15.00	26.00	27.00	23.00	23.00	22.00	31.00
2	28.00	22.00	22.00	25.00	27.00	20.00	29.00	24.00	26.00	29.00
3	23.00	28.00	28.00	33.00	27.00	28.00	29.00	24.00	23.00	26.00
4	27.00	30.00	28.00	25.00	27.00	26.00	27.00	26.00	26.00	26.00
5	28.00	26.00	27.00	23.00	24.00	28.00	27.00	26.00	26.00	25.00
6	26.00	26.00	24.00	24.00	24.00	23.00	28.00	24.00	26.00	27.00
7	26.00	29.00	26.00	26.00	28.00	24.00	26.00	24.00	25.00	28.00
8	25.00	28.00	23.00	29.00	29.00	25.00	26.00	28.00	26.00	28.00
9	28.00	28.00	26.00	26.00	26.00	24.00	25.00	28.00	26.00	26.00
10	24.00	23.00	26.00	27.00	21.00	29.00	22.00	27.00	26.00	26.00
11	24.00	27.00	26.00	27.00	29.00	25.00	25.00	27.00	28.00	29.00
12	25.00	27.00	25.00	25.00	29.00	21.00	25.00	26.00	21.00	29.00
13	26.00	27.00	24.00	26.00	27.00	23.00	27.00	26.00	31.00	27.00
14	26.00	22.00	28.00	26.00	28.00	28.00	24.00	28.00	25.00	27.00
15	26.00	25.00	24.00	26.00	26.00	28.00	23.00	28.00	25.00	26.00
16	23.00	25.00	24.00	27.00	26.00	23.00	25.00	26.00	28.00	20.00
17	24.00	25.00	28.00	29.00	28.00	21.00	26.00	27.00	30.00	23.00
18	28.00	27.00	27.00	30.00	29.00	26.00	27.00	18.00	27.00	20.00
19	28.00	24.00	27.00	26.00	33.00	26.00	28.00	25.00	29.00	28.00
20	27.00	28.00	27.00	24.00	26.00	29.00	28.00	25.00	27.00	28.00

**HISTOGRAMA DE LO DATOS RECOLECTADOS**





**CALCULO DEL RANGO "D"**

Se depuran un total de 10% de los datos siendo 5% por cada extremo del histograma

<b>Lado izquierdo</b>	
Valor a dividir (di) =	<b>5</b>
Existente (ei) =	9
Faltante (fi) =	<b>1</b>

<b>Lado derecho</b>	
Valor a dividir (dd) =	<b>15</b>
Existente (ed) =	7
Faltante (fd) =	<b>3</b>

N° de intervalos

Rango medio (dm) = **6**

Entonces "D" viene a ser:

$$D = \left( \frac{(d_i - f_i)}{d_i} + d_m + \frac{(d_d - f_d)}{d_d} \right) * 5 [mm]$$

D= 38 mm

**CÁLCULO FACTOR DE CORRECCIÓN fc:**

Donde:

Ep = 6.2  
 Li = 25  
 Lf = 15

$$f_c = \left( \frac{(E_p * 10)}{(L_i - L_f) * 5} \right)$$

fc = 1.24 mm

**CÁLCULO DEL RANGO CORREGIDO Dc:**

$D_c = D * f_c$

Dc = 47.12 mm

**DETERMINACIÓN DEL I.R.I.:**

Para pavimentos nuevos:

I. R. I. = 0.0485 \* D<sub>c</sub>

→ (IRI < 2.4)

Para pavimentos en servicio:

I. R. I. = 0.593 + 0.0471 \* D<sub>c</sub>

→ (2.4 < IRI < 15.9)

**CÁLCULO DEL I.R.I.:**

Aplicando la fórmula para pavimentos en servicio:

I. R. I. = 0.593 + 0.0471 \* D<sub>c</sub>

I.R.I. = 2.81 m/km



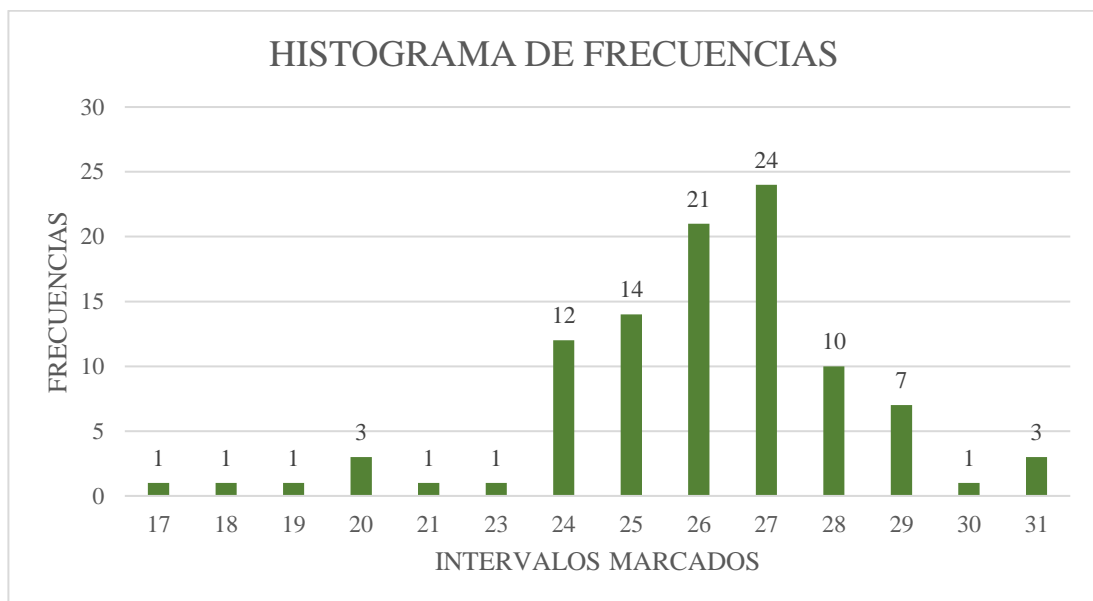
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 LABORATORIO DE ASFALTOS

Nombre del tramo: Av. Jesús Molina (Cruce ruta San Jacinto - Casa del Mariachi)

Carril de ida Progresiva: 0+800 a 1+000

	1	2	3	4	5	6	7	8	9	10
1	28.00	26.00	28.00	24.00	27.00	23.00	28.00	28.00	27.00	23.00
2	28.00	29.00	26.00	28.00	27.00	23.00	28.00	31.00	24.00	24.00
3	28.00	31.00	26.00	27.00	25.00	27.00	22.00	19.00	24.00	25.00
4	25.00	27.00	29.00	28.00	27.00	21.00	28.00	25.00	26.00	25.00
5	26.00	31.00	25.00	31.00	24.00	29.00	31.00	23.00	25.00	22.00
6	26.00	26.00	25.00	17.00	27.00	29.00	27.00	25.00	23.00	26.00
7	27.00	26.00	27.00	21.00	26.00	23.00	27.00	24.00	25.00	26.00
8	27.00	23.00	27.00	29.00	26.00	26.00	26.00	27.00	25.00	29.00
9	27.00	25.00	24.00	26.00	24.00	29.00	26.00	27.00	24.00	28.00
10	18.00	25.00	27.00	29.00	28.00	26.00	28.00	23.00	26.00	25.00
11	26.00	27.00	20.00	24.00	28.00	20.00	27.00	23.00	25.00	26.00
12	29.00	24.00	20.00	30.00	26.00	23.00	27.00	25.00	30.00	27.00
13	29.00	26.00	29.00	24.00	24.00	23.00	24.00	25.00	27.00	27.00
14	28.00	26.00	25.00	20.00	27.00	23.00	25.00	22.00	27.00	25.00
15	25.00	26.00	24.00	24.00	27.00	27.00	25.00	27.00	24.00	27.00
16	25.00	26.00	28.00	27.00	27.00	27.00	25.00	28.00	24.00	23.00
17	25.00	27.00	24.00	26.00	24.00	27.00	27.00	24.00	29.00	26.00
18	25.00	25.00	19.00	26.00	27.00	21.00	24.00	24.00	27.00	26.00
19	27.00	26.00	27.00	26.00	25.00	26.00	26.00	27.00	25.00	24.00
20	27.00	26.00	27.00	27.00	25.00	24.00	26.00	28.00	25.00	27.00

### HISTOGRAMA DE LO DATOS RECOLECTADOS





**CALCULO DEL RANGO "D"**

Se depuran un total de 10% de los datos siendo 5% por cada extremo del histograma

Lado izquierdo	
Valor a dividir (di) =	12
Existente (ei) =	8
Faltante (fi) =	2

Lado derecho	
Valor a dividir (dd) =	7
Existente (ed) =	4
Faltante (fd) =	6

N° de intervalos

Rango medio (dm) = 4

Entonces "D" viene a ser:

$$D = \left( \frac{(d_i - f_i)}{d_i} + d_m + \frac{(d_d - f_d)}{d_d} \right) * 5 [mm]$$

D= 24.88 mm

**CÁLCULO FACTOR DE CORRECCIÓN fc:**

Donde:

Ep = 6.2  
 Li = 25  
 Lf = 15

$$f_c = \left( \frac{(E_p * 10)}{(L_i - L_f) * 5} \right)$$

fc = 1.24 mm

**CÁLCULO DEL RANGO CORREGIDO Dc:**

Dc = D \* fc

Dc = 30.85 mm

**DETERMINACIÓN DEL I.R.I.:**

Para pavimentos nuevos:

I. R. I. = 0.0485 \* Dc

→ (IRI < 2.4)

Para pavimentos en servicio:

I. R. I. = 0.593 + 0.0471 \* Dc

→ (2.4 < IRI < 15.9)

**CÁLCULO DEL I.R.I.:**

Aplicando la fórmula para pavimentos en servicio:

I. R. I. = 0.593 + 0.0471 \* Dc

I.R.I. = 2.05 m/km



**UNIVERSIDAD AUTÓNOMA JUAN MISAEL SARACHO**  
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**CARRERA DE INGENIERIA CIVIL**  
**LABORATORIO DE ASFALTOS**

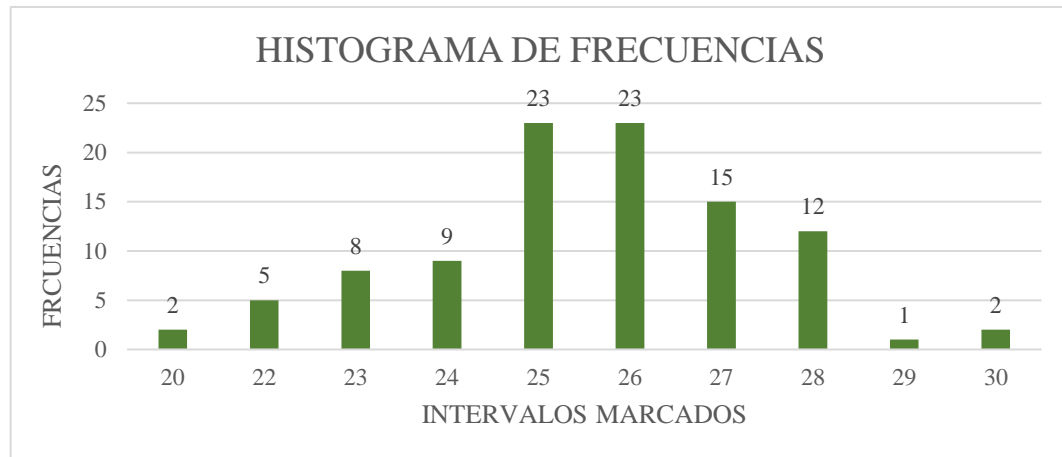
**Nombre del tramo:** Av. Jesús Molina (Cruce ruta San Jacinto - Casa del Mariachi)

**Carril de vuelta** Progresiva: 1+000 a 0+800

**Huella 1**

	1	2	3	4	5	6	7	8	9	10
1	27.00	25.00	27.00	24.00	26.00	24.00	27.00	27.00	27.00	25.00
2	27.00	29.00	25.00	28.00	25.00	22.00	27.00	30.00	25.00	24.00
3	27.00	30.00	25.00	26.00	25.00	26.00	22.00	20.00	23.00	26.00
4	24.00	26.00	29.00	27.00	26.00	20.00	27.00	25.00	26.00	26.00
5	26.00	30.00	24.00	30.00	25.00	28.00	30.00	23.00	25.00	25.00
6	25.00	26.00	25.00	18.00	27.00	28.00	25.00	28.00	24.00	26.00
7	27.00	27.00	27.00	22.00	25.00	23.00	26.00	24.00	26.00	28.00
8	26.00	23.00	25.00	28.00	26.00	26.00	25.00	26.00	25.00	27.00
9	27.00	24.00	23.00	25.00	25.00	28.00	26.00	27.00	24.00	28.00
10	19.00	24.00	27.00	28.00	28.00	25.00	28.00	26.00	26.00	27.00
11	25.00	27.00	20.00	23.00	25.00	22.00	27.00	23.00	25.00	28.00
12	29.00	24.00	20.00	30.00	27.00	23.00	26.00	25.00	29.00	27.00
13	26.00	26.00	28.00	24.00	25.00	24.00	24.00	25.00	27.00	28.00
14	27.00	26.00	25.00	20.00	27.00	23.00	26.00	22.00	27.00	25.00
15	25.00	25.00	23.00	25.00	27.00	26.00	25.00	25.00	25.00	26.00
16	27.00	25.00	28.00	27.00	27.00	26.00	25.00	28.00	25.00	28.00
17	25.00	27.00	24.00	25.00	25.00	26.00	27.00	23.00	28.00	23.00
18	25.00	25.00	19.00	25.00	27.00	22.00	25.00	24.00	27.00	26.00
19	26.00	24.00	26.00	25.00	25.00	25.00	26.00	26.00	26.00	25.00
20	27.00	25.00	26.00	26.00	24.00	24.00	25.00	27.00	25.00	26.00

**HISTOGRAMA DE LO DATOS RECOLECTADOS**





**CALCULO DEL RANGO "D"**

Se depuran un total de 10% de los datos siendo 5% por cada extremo del histograma

<b>Lado izquierdo</b>	
Valor a dividir (di) =	<b>8</b>
Existente (ei) =	7
Faltante (fi) =	<b>3</b>

<b>Lado derecho</b>	
Valor a dividir (dd) =	<b>12</b>
Existente (ed) =	3
Faltante (fd) =	<b>7</b>

N° de intervalos

Rango medio (dm) = **4**

Entonces "D" viene a ser:

$$D = \left( \frac{(d_i - f_i)}{d_i} + d_m + \frac{(d_d - f_d)}{d_d} \right) * 5 [mm]$$

D= 25.21 mm

**CÁLCULO FACTOR DE CORRECCIÓN fc:**

Donde:

- Ep = 6.2
- Li = 25
- Lf = 15

$$f_c = \left( \frac{(E_p * 10)}{(L_i - L_f) * 5} \right)$$

fc = 1.24 mm

**CÁLCULO DEL RANGO CORREGIDO Dc:**

$$D_c = D * f_c$$

Dc = 31.26 mm

**DETERMINACIÓN DEL I.R.I.:**

Para pavimentos nuevos:

I.R.I. = 0.0485 \* D<sub>c</sub>



(IRI<2.4)

Para pavimentos en servicio:

I.R.I. = 0.593 + 0.0471 \* D<sub>c</sub>



(2.4<IRI<15.9)

**CÁLCULO DEL I.R.I.:**

Aplicando la fórmula para pavimentos en servicio:

I.R.I. = 0.593 + 0.0471 \* D<sub>c</sub>

**I.R.I.= 2.07 m/km**





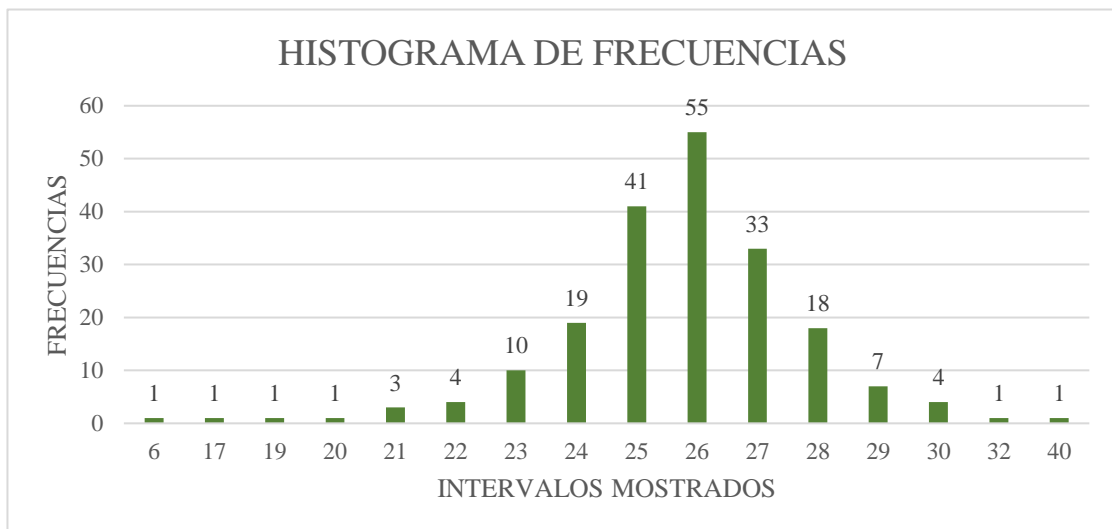
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**DPTO. DE TOPOGRAFIA Y VÍAS DE COMUNICACIÓN**  
**CARRERA DE INGENIERIA CIVIL**  
**LABORATORIO DE ASFALTOS**

**Nombre del tramo:** Av. Jesús Molina (Cruce ruta San Jacinto - Casa del Mariachi)

**Carril de vuelta** Progresiva: 0+800 a 0+400

	1	2	3	4	5	6	7	8	9	10
1	26.00	25.00	22.00	25.00	25.00	26.00	25.00	40.00	26.00	24.00
2	25.00	27.00	27.00	26.00	26.00	25.00	27.00	28.00	21.00	30.00
3	24.00	26.00	27.00	26.00	23.00	29.00	23.00	26.00	25.00	25.00
4	29.00	29.00	25.00	26.00	24.00	25.00	26.00	29.00	25.00	26.00
5	26.00	26.00	27.00	25.00	27.00	26.00	24.00	25.00	26.00	25.00
6	27.00	29.00	27.00	26.00	25.00	24.00	24.00	27.00	23.00	27.00
7	26.00	24.00	24.00	25.00	24.00	25.00	26.00	26.00	23.00	21.00
8	27.00	26.00	26.00	26.00	25.00	26.00	25.00	22.00	27.00	26.00
9	26.00	27.00	27.00	25.00	25.00	26.00	28.00	25.00	17.00	25.00
10	24.00	26.00	23.00	27.00	28.00	29.00	28.00	32.00	27.00	23.00
11	23.00	27.00	26.00	26.00	26.00	24.00	20.00	23.00	21.00	26.00
12	30.00	27.00	24.00	26.00	26.00	6.00	26.00	29.00	28.00	24.00
13	25.00	25.00	27.00	26.00	28.00	26.00	26.00	28.00	25.00	24.00
14	26.00	25.00	26.00	27.00	26.00	25.00	26.00	27.00	28.00	25.00
15	26.00	25.00	24.00	27.00	27.00	25.00	26.00	28.00	28.00	25.00
16	26.00	27.00	24.00	28.00	28.00	28.00	28.00	30.00	23.00	22.00
17	26.00	27.00	26.00	25.00	26.00	28.00	25.00	25.00	27.00	27.00
18	27.00	27.00	26.00	26.00	27.00	24.00	22.00	28.00	28.00	27.00
19	28.00	26.00	26.00	26.00	25.00	25.00	19.00	24.00	27.00	30.00
20	26.00	27.00	26.00	25.00	26.00	25.00	25.00	24.00	23.00	25.00

**HISTOGRAMA DE LO DATOS RECOLECTADOS**





**CALCULO DEL RANGO "D"**

Se depuran un total de 10% de los datos siendo 5% por cada extremo del histograma

Lado izquierdo	
Valor a dividir (di) =	<b>4</b>
Existente (ei) =	7
Faltante (fi) =	<b>3</b>

Lado derecho	
Valor a dividir (dd) =	<b>7</b>
Existente (ed) =	6
Faltante (fd) =	<b>4</b>

N° de intervalos

Rango medio (dm) = **6**

Entonces "D" viene a ser:

$$D = \left( \frac{(d_i - f_i)}{d_i} + d_m + \frac{(d_d - f_d)}{d_d} \right) * 5 [mm]$$

D= 33.39 mm

**CÁLCULO FACTOR DE CORRECCIÓN fc:**

Donde:

Ep = 6.2  
 Li = 25  
 Lf = 15

$$f_c = \left( \frac{(E_p * 10)}{(L_i - L_f) * 5} \right)$$

fc = 1.24 mm

**CÁLCULO DEL RANGO CORREGIDO Dc:**

$D_c = D * f_c$

Dc = 41.41 mm

**DETERMINACIÓN DEL I.R.I.:**

Para pavimentos nuevos:

I. R. I. =  $0.0485 * D_c$

→ (IRI < 2.4)

Para pavimentos en servicio:

I. R. I. =  $0.593 + 0.0471 * D_c$

→ (2.4 < IRI < 15.9)

**CÁLCULO DEL I.R.I.:**

Aplicando la fórmula para pavimentos en servicio:

I. R. I. =  $0.593 + 0.0471 * D_c$

I.R.I. = 2.54 m/km



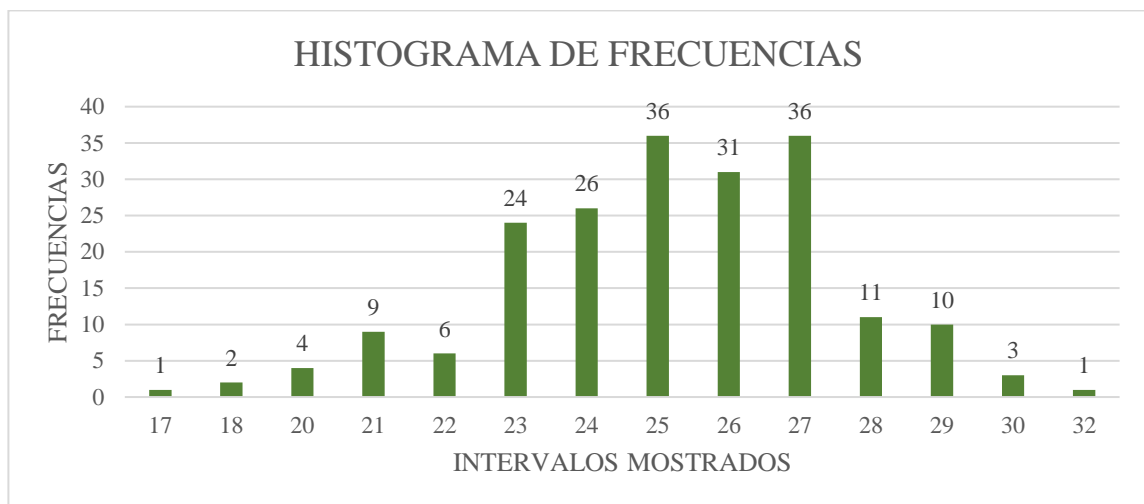
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**CARRERA DE INGENIERIA CIVIL**  
**LABORATORIO DE ASFALTOS**

**Nombre del tramo:** Av. Jesús Molina (Cruce ruta San Jacinto - Casa del Mariachi)

**Carril de vuelta** Progresiva: 0+400 a 0+000

	1	2	3	4	5	6	7	8	9	10
1	26.00	27.00	22.00	25.00	24.00	23.00	26.00	21.00	25.00	18.00
2	17.00	21.00	27.00	27.00	22.00	28.00	25.00	27.00	28.00	26.00
3	23.00	27.00	27.00	24.00	26.00	28.00	24.00	29.00	24.00	26.00
4	26.00	26.00	24.00	24.00	24.00	25.00	25.00	25.00	27.00	23.00
5	29.00	23.00	24.00	20.00	25.00	27.00	26.00	23.00	29.00	27.00
6	27.00	22.00	24.00	25.00	24.00	25.00	27.00	21.00	28.00	29.00
7	24.00	20.00	23.00	25.00	26.00	25.00	26.00	27.00	27.00	18.00
8	26.00	25.00	22.00	27.00	25.00	26.00	23.00	25.00	24.00	27.00
9	23.00	29.00	23.00	26.00	27.00	26.00	25.00	26.00	26.00	25.00
10	24.00	25.00	24.00	21.00	27.00	25.00	27.00	23.00	27.00	25.00
11	28.00	30.00	25.00	21.00	27.00	26.00	25.00	27.00	28.00	21.00
12	25.00	28.00	25.00	21.00	25.00	25.00	25.00	23.00	27.00	25.00
13	24.00	32.00	23.00	24.00	25.00	26.00	24.00	24.00	28.00	23.00
14	27.00	29.00	24.00	23.00	26.00	28.00	24.00	21.00	30.00	26.00
15	27.00	24.00	23.00	23.00	25.00	25.00	29.00	22.00	27.00	26.00
16	28.00	20.00	26.00	23.00	25.00	27.00	27.00	29.00	26.00	24.00
17	20.00	23.00	23.00	24.00	26.00	27.00	27.00	24.00	26.00	27.00
18	23.00	27.00	25.00	26.00	26.00	25.00	27.00	30.00	26.00	28.00
19	24.00	27.00	27.00	23.00	27.00	26.00	22.00	23.00	29.00	29.00
20	25.00	26.00	21.00	23.00	26.00	25.00	24.00	25.00	23.00	27.00

**HISTOGRAMA DE LO DATOS RECOLECTADOS**





**CALCULO DEL RANGO "D"**

Se depuran un total de 10% de los datos siendo 5% por cada extremo del histograma

<b>Lado izquierdo</b>	
Valor a dividir (di) =	<b>9</b>
Existente (ei) =	7
Faltante (fi) =	<b>3</b>

<b>Lado derecho</b>	
Valor a dividir (dd) =	<b>10</b>
Existente (ed) =	4
Faltante (fd) =	<b>6</b>

N° de intervalos

Rango medio (dm) = **7**

Entonces "D" viene a ser:

$$D = \left( \frac{(d_i - f_i)}{d_i} + d_m + \frac{(d_d - f_d)}{d_d} \right) * 5 [mm]$$

D= 40.33 mm

**CÁLCULO FACTOR DE CORRECCIÓN fc:**

Donde:

Ep = 6.2  
 Li = 25  
 Lf = 15

$$f_c = \left( \frac{(E_p * 10)}{(L_i - L_f) * 5} \right)$$

fc = 1.24 mm

**CÁLCULO DEL RANGO CORREGIDO Dc:**

$$D_c = D * f_c$$

Dc = 50.01 mm

**DETERMINACIÓN DEL I.R.I.:**

Para pavimentos nuevos:

$$I. R. I. = 0.0485 * D_c$$

(IRI < 2.4)

Para pavimentos en servicio:

$$I. R. I. = 0.593 + 0.0471 * D_c$$

(2.4 < IRI < 15.9)

**CÁLCULO DEL I.R.I.:**

Aplicando la fórmula para pavimentos en servicio:

$$I. R. I. = 0.593 + 0.0471 * D_c$$

**I.R.I. = 2.95 m/km**



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**LABORATORIO DE ASFALTOS**

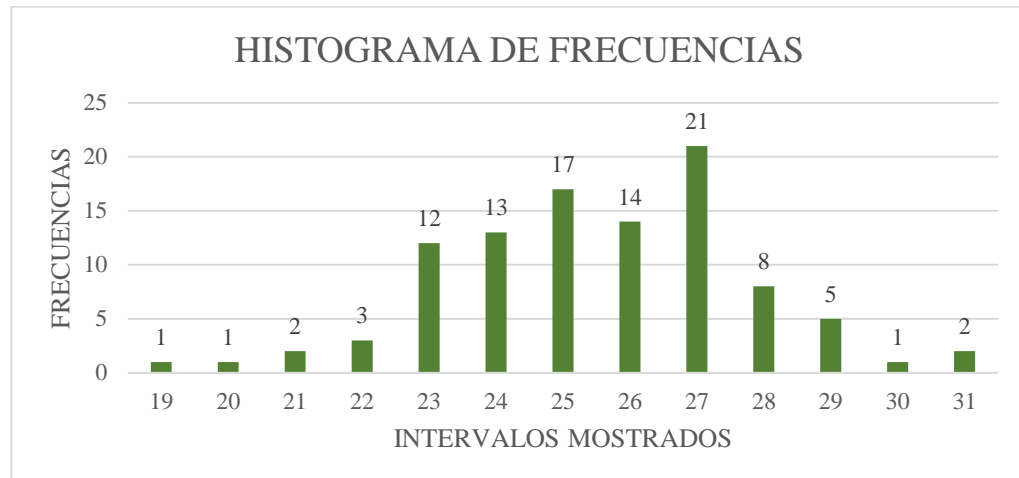
**Nombre del tramo:** Av. Jesús Molina (Cruce ruta San Jacinto - Casa del Mariachi)

**Carril de vuelta** Progresiva: 1+000 a 0+800

**Huella 2**

	1	2	3	4	5	6	7	8	9	10
1	28.00	26.00	28.00	24.00	27.00	23.00	28.00	28.00	27.00	23.00
2	28.00	29.00	26.00	28.00	27.00	23.00	28.00	31.00	24.00	24.00
3	28.00	31.00	26.00	27.00	25.00	27.00	22.00	19.00	24.00	25.00
4	25.00	27.00	29.00	28.00	27.00	21.00	28.00	25.00	26.00	25.00
5	26.00	31.00	25.00	31.00	24.00	29.00	31.00	23.00	25.00	22.00
6	26.00	26.00	25.00	17.00	27.00	29.00	27.00	25.00	23.00	26.00
7	27.00	26.00	27.00	21.00	26.00	23.00	27.00	24.00	25.00	26.00
8	27.00	23.00	27.00	29.00	26.00	26.00	26.00	27.00	25.00	29.00
9	27.00	25.00	24.00	26.00	24.00	29.00	26.00	27.00	24.00	28.00
10	18.00	25.00	27.00	29.00	28.00	26.00	28.00	23.00	26.00	25.00
11	26.00	27.00	20.00	24.00	28.00	20.00	27.00	23.00	25.00	26.00
12	29.00	24.00	20.00	30.00	26.00	23.00	27.00	25.00	30.00	27.00
13	29.00	26.00	29.00	24.00	24.00	23.00	24.00	25.00	27.00	27.00
14	28.00	26.00	25.00	20.00	27.00	23.00	25.00	22.00	27.00	25.00
15	25.00	26.00	24.00	24.00	27.00	27.00	25.00	27.00	24.00	27.00
16	25.00	26.00	28.00	27.00	27.00	27.00	25.00	28.00	24.00	23.00
17	25.00	27.00	24.00	26.00	24.00	27.00	27.00	24.00	29.00	26.00
18	25.00	25.00	19.00	26.00	27.00	21.00	24.00	24.00	27.00	26.00
19	27.00	26.00	27.00	26.00	25.00	26.00	26.00	27.00	25.00	24.00
20	27.00	26.00	27.00	27.00	25.00	24.00	26.00	28.00	25.00	27.00

**HISTOGRAMA DE LO DATOS RECOLECTADOS**





**CALCULO DEL RANGO "D"**

Se depuran un total de 10% de los datos siendo 5% por cada extremo del histograma

Lado izquierdo	
Valor a dividir (di) =	<b>12</b>
Existente (ei) =	7
Faltante (fi) =	<b>3</b>

Lado derecho	
Valor a dividir (dd) =	<b>8</b>
Existente (ed) =	8
Faltante (fd) =	<b>2</b>

N° de intervalos

Rango medio (dm) = **4**

Entonces "D" viene a ser:

$$D = \left( \frac{(d_i - f_i)}{d_i} + d_m + \frac{(d_d - f_d)}{d_d} \right) * 5 [mm]$$

D= 27.5 mm

**CÁLCULO FACTOR DE CORRECCIÓN fc:**

Donde:

- Ep = 6.2
- Li = 25
- Lf = 15

$$f_c = \left( \frac{(E_p * 10)}{(L_i - L_f) * 5} \right)$$

fc = 1.24 mm

**CÁLCULO DEL RANGO CORREGIDO Dc:**

$$D_c = D * f_c$$

Dc = 34.1 mm

**DETERMINACIÓN DEL I.R.I.:**

Para pavimentos nuevos:

$$I.R.I. = 0.0485 * D_c$$

→ (IRI<2.4)

Para pavimentos en servicio:

$$I.R.I. = 0.593 + 0.0471 * D_c$$

→ (2.4<IRI<15.9)

**CÁLCULO DEL I.R.I.:**

Aplicando la fórmula para pavimentos en servicio:

$$I.R.I. = 0.593 + 0.0471 * D_c$$

**I.R.I. = 2.20 m/km**



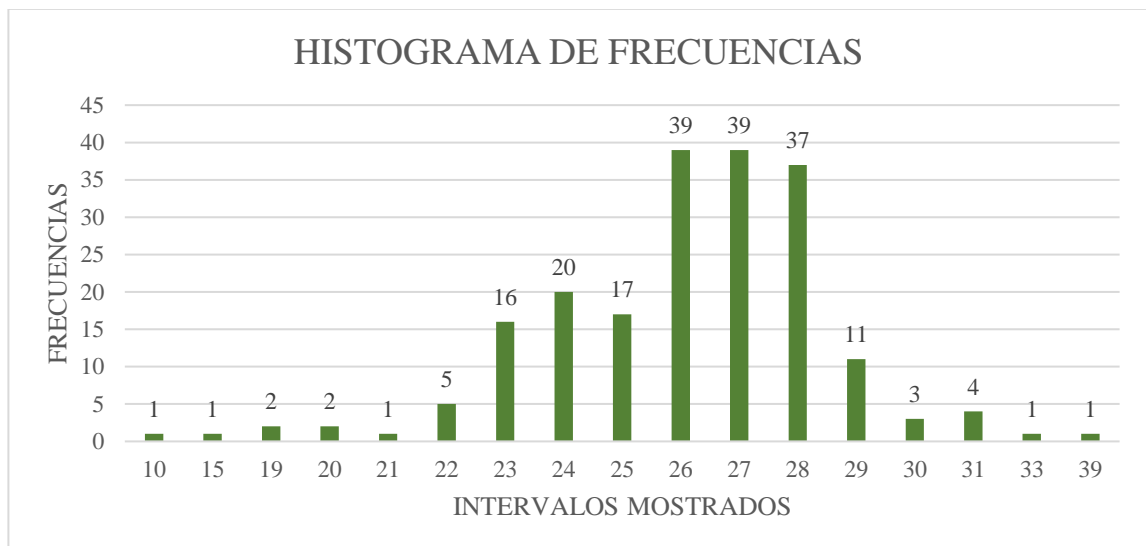
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 LABORATORIO DE ASFALTOS

Nombre del tramo: Av. Jesús Molina (Cruce ruta San Jacinto - Casa del Mariachi)

Carril de vuelta Progresiva: 0+800 a 0+400

	1	2	3	4	5	6	7	8	9	10
1	27.00	28.00	23.00	24.00	24.00	26.00	27.00	39.00	27.00	25.00
2	27.00	27.00	28.00	26.00	27.00	26.00	27.00	28.00	22.00	31.00
3	25.00	26.00	28.00	26.00	24.00	30.00	24.00	27.00	23.00	26.00
4	29.00	30.00	24.00	26.00	24.00	26.00	27.00	29.00	23.00	26.00
5	29.00	26.00	27.00	25.00	28.00	26.00	24.00	29.00	26.00	26.00
6	28.00	30.00	27.00	27.00	28.00	24.00	24.00	27.00	23.00	27.00
7	28.00	24.00	24.00	25.00	24.00	25.00	27.00	27.00	23.00	21.00
8	27.00	28.00	28.00	27.00	25.00	25.00	26.00	22.00	26.00	26.00
9	27.00	27.00	28.00	28.00	25.00	28.00	28.00	26.00	15.00	23.00
10	23.00	28.00	24.00	27.00	28.00	29.00	28.00	33.00	27.00	23.00
11	22.00	27.00	26.00	24.00	25.00	27.00	19.00	23.00	20.00	26.00
12	31.00	27.00	26.00	26.00	25.00	10.00	26.00	29.00	28.00	26.00
13	28.00	26.00	28.00	25.00	28.00	27.00	26.00	29.00	25.00	24.00
14	26.00	26.00	28.00	28.00	28.00	27.00	26.00	27.00	28.00	25.00
15	26.00	26.00	24.00	27.00	27.00	27.00	26.00	29.00	28.00	25.00
16	26.00	27.00	24.00	28.00	28.00	28.00	29.00	31.00	23.00	23.00
17	26.00	27.00	23.00	28.00	25.00	28.00	27.00	25.00	28.00	27.00
18	28.00	27.00	23.00	26.00	25.00	24.00	22.00	29.00	28.00	27.00
19	28.00	27.00	23.00	26.00	24.00	26.00	19.00	23.00	28.00	31.00
20	29.00	28.00	26.00	27.00	24.00	26.00	20.00	23.00	22.00	26.00

HISTOGRAMA DE LO DATOS RECOLECTADOS





**CALCULO DEL RANGO "D"**

Se depuran un total de 10% de los datos siendo 5% por cada extremo del histograma

Lado izquierdo	
Valor a dividir (di) =	<b>5</b>
Existente (ei) =	7
Faltante (fi) =	<b>3</b>

Lado derecho	
Valor a dividir (dd) =	<b>11</b>
Existente (ed) =	9
Faltante (fd) =	<b>1</b>

N° de intervalos

Rango medio (dm) = **6**

Entonces "D" viene a ser:

$$D = \left( \frac{(d_i - f_i)}{d_i} + d_m + \frac{(d_d - f_d)}{d_d} \right) * 5 [mm]$$

$$D = 36.54 \text{ mm}$$

**CÁLCULO FACTOR DE CORRECCIÓN fc:**

Donde:

$$E_p = 6.2$$

$$L_i = 25$$

$$L_f = 15$$

$$f_c = \left( \frac{(E_p * 10)}{(L_i - L_f) * 5} \right)$$

$$f_c = 1.24 \text{ mm}$$

**CÁLCULO DEL RANGO CORREGIDO Dc:**

$$D_c = D * f_c$$

$$D_c = 45.32 \text{ mm}$$

**DETERMINACIÓN DEL I.R.I.:**

Para pavimentos nuevos:

$$I.R.I. = 0.0485 * D_c$$

→ (IRI < 2.4)

Para pavimentos en servicio:

$$I.R.I. = 0.593 + 0.0471 * D_c$$

→ (2.4 < IRI < 15.9)

**CÁLCULO DEL I.R.I.:**

Aplicando la fórmula para pavimentos en servicio:

$$I.R.I. = 0.593 + 0.0471 * D_c$$

$$I.R.I. = 2.73 \text{ m/km}$$





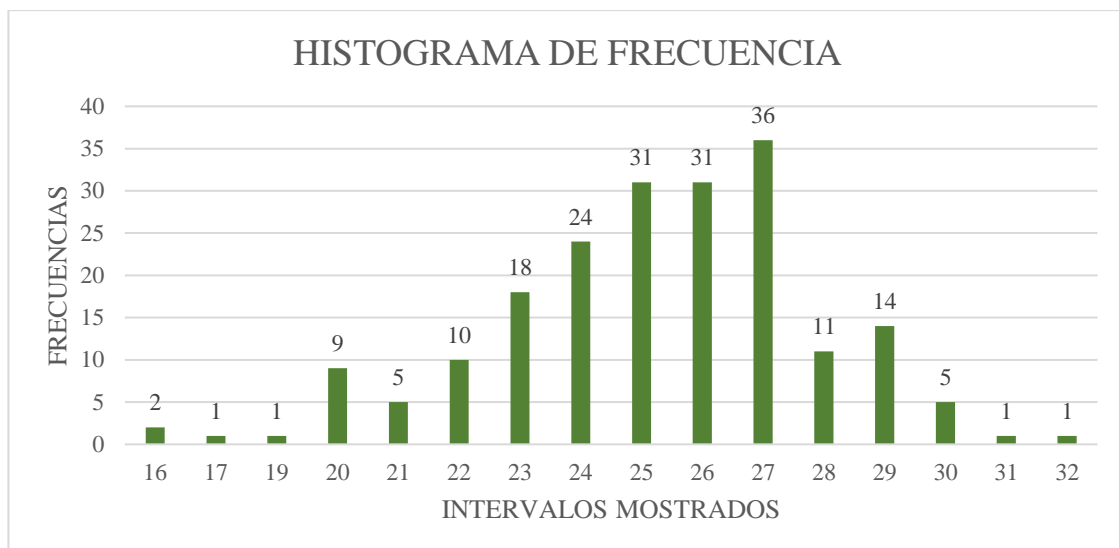
**UNIVERSIDAD AUTÓNOMA JUAN MISAEL SARACHO**  
**FACULTAD CIENCIAS Y TECNOLOGÍA**  
**DPTO. DE TOPOGRAFIA Y VÍAS DE COMUNICACIÓN**  
**CARRERA DE INGENIERIA CIVIL**  
**LABORATORIO DE ASFALTOS**

**Nombre del tramo:** Av. Jesús Molina (Cruce ruta San Jacinto - Casa del Mariachi)

**Carril de vuelta** Progresiva: 0+400 a 0+000

	1	2	3	4	5	6	7	8	9	10
1	27.00	23.00	22.00	25.00	22.00	22.00	27.00	28.00	25.00	16.00
2	16.00	21.00	26.00	25.00	20.00	28.00	27.00	29.00	29.00	26.00
3	23.00	27.00	26.00	24.00	25.00	28.00	24.00	29.00	25.00	26.00
4	27.00	26.00	24.00	24.00	24.00	25.00	24.00	25.00	26.00	24.00
5	29.00	26.00	24.00	19.00	25.00	27.00	26.00	21.00	29.00	27.00
6	27.00	22.00	24.00	25.00	23.00	25.00	27.00	21.00	28.00	29.00
7	24.00	20.00	22.00	25.00	26.00	25.00	27.00	27.00	28.00	17.00
8	24.00	25.00	22.00	27.00	27.00	26.00	23.00	25.00	24.00	26.00
9	23.00	30.00	25.00	26.00	27.00	26.00	25.00	26.00	26.00	25.00
10	24.00	26.00	24.00	20.00	27.00	23.00	27.00	27.00	27.00	25.00
11	29.00	31.00	25.00	20.00	27.00	26.00	24.00	27.00	27.00	20.00
12	25.00	29.00	25.00	20.00	25.00	25.00	24.00	24.00	27.00	25.00
13	24.00	32.00	23.00	25.00	25.00	26.00	24.00	24.00	28.00	23.00
14	27.00	29.00	24.00	23.00	27.00	28.00	24.00	21.00	30.00	26.00
15	27.00	29.00	23.00	23.00	25.00	29.00	29.00	20.00	27.00	26.00
16	27.00	20.00	27.00	23.00	25.00	27.00	26.00	29.00	26.00	24.00
17	20.00	22.00	22.00	24.00	26.00	27.00	26.00	29.00	26.00	28.00
18	23.00	27.00	23.00	26.00	26.00	25.00	27.00	30.00	26.00	28.00
19	25.00	27.00	27.00	22.00	28.00	26.00	22.00	23.00	30.00	30.00
20	25.00	27.00	23.00	21.00	28.00	26.00	23.00	26.00	23.00	27.00

**HISTOGRAMA DE LO DATOS RECOLECTADOS**





**CALCULO DEL RANGO "D"**

Se depuran un total de 10% de los datos siendo 5% por cada extremo del histograma

Lado izquierdo	
Valor a dividir (di) =	<b>9</b>
Existente (ei) =	4
Faltante (fi) =	<b>6</b>

Lado derecho	
Valor a dividir (dd) =	<b>14</b>
Existente (ed) =	7
Faltante (fd) =	<b>3</b>

N° de intervalos

Rango medio (dm) = **8**

Entonces "D" viene a ser:

$$D = \left( \frac{(d_i - f_i)}{d_i} + d_m + \frac{(d_d - f_d)}{d_d} \right) * 5 [mm]$$

$$D = 45.60 \text{ mm}$$

**CÁLCULO FACTOR DE CORRECCIÓN fc:**

Donde:

- Ep = 6.2
- Li = 25
- Lf = 15

$$f_c = \left( \frac{(E_p * 10)}{(L_i - L_f) * 5} \right)$$

$$f_c = 1.24 \text{ mm}$$

**CÁLCULO DEL RANGO CORREGIDO Dc:**

$$D_c = D * f_c$$

$$D_c = 56.54 \text{ mm}$$

**DETERMINACIÓN DEL I.R.I.:**

Para pavimentos nuevos:

$$I. R. I. = 0.0485 * D_c \implies (IRI < 2.4)$$

Para pavimentos en servicio:

$$I. R. I. = 0.593 + 0.0471 * D_c \implies (2.4 < IRI < 15.9)$$

**CÁLCULO DEL I.R.I.:**

Aplicando la fórmula para pavimentos en servicio:

$$I. R. I. = 0.593 + 0.0471 * D_c$$

$$I.R.I. = 3.26 \text{ m/km}$$



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 CARRERA DE INGENIERIA CIVIL  
 LABORATORIO DE ASFALTOS

Nombre del laboratorista/tesista: Alejandra Ramos Quispe

Fecha de realización del ensayo: 24-09-2022

Número de muestra: 2

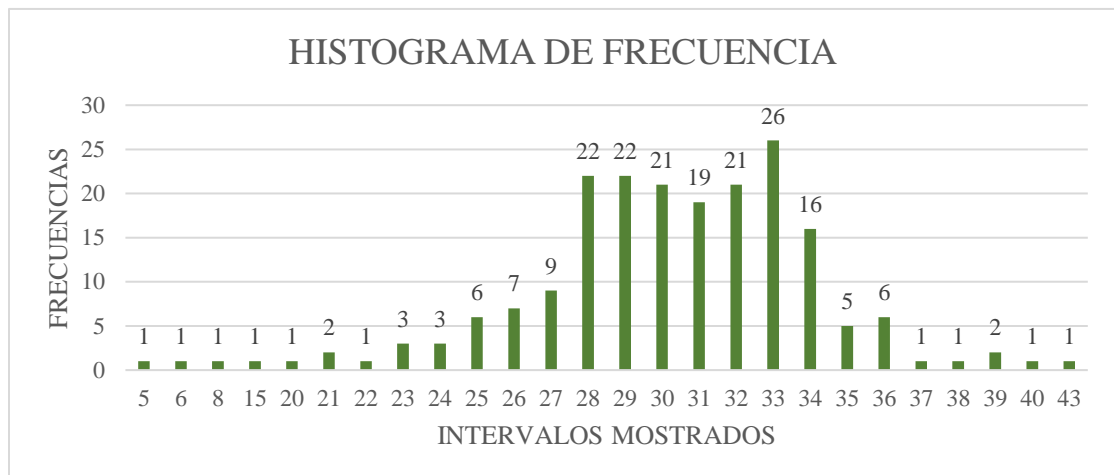
Nombre del tramo: Av. Felipe Palazón (Rotonda Los Leones - Calle 10)

Carril de ida Progresiva: 0+000 a 0+400

**Huella 1**

	1	2	3	4	5	6	7	9	10
1	30.00	33.00	29.00	33.00	31.00	29.00	36.00	35.00	23.00
2	22.00	25.00	27.00	34.00	32.00	33.00	28.00	31.00	34.00
3	34.00	39.00	29.00	32.00	31.00	30.00	35.00	32.00	33.00
4	25.00	26.00	29.00	29.00	28.00	30.00	36.00	29.00	28.00
5	38.00	30.00	8.00	32.00	30.00	28.00	33.00	31.00	23.00
6	29.00	33.00	43.00	31.00	28.00	26.00	27.00	29.00	33.00
7	35.00	28.00	33.00	27.00	33.00	30.00	27.00	34.00	37.00
8	33.00	31.00	34.00	32.00	29.00	30.00	33.00	28.00	32.00
9	30.00	26.00	5.00	29.00	28.00	32.00	34.00	24.00	28.00
10	26.00	28.00	28.00	31.00	32.00	30.00	29.00	31.00	36.00
11	31.00	28.00	29.00	32.00	29.00	33.00	30.00	27.00	25.00
12	26.00	35.00	39.00	29.00	31.00	34.00	33.00	29.00	30.00
13	24.00	33.00	20.00	30.00	32.00	32.00	27.00	27.00	30.00
14	31.00	28.00	21.00	32.00	36.00	34.00	30.00	29.00	25.00
15	32.00	31.00	34.00	33.00	33.00	31.00	30.00	30.00	34.00
16	35.00	29.00	27.00	30.00	30.00	24.00	28.00	31.00	32.00
17	21.00	33.00	31.00	36.00	33.00	23.00	27.00	34.00	32.00
18	34.00	29.00	25.00	34.00	31.00	34.00	26.00	30.00	33.00
19	33.00	28.00	28.00	25.00	33.00	28.00	31.00	32.00	36.00
20	34.00	33.00	29.00	28.00	33.00	6.00	33.00	15.00	28.00

**HISTOGRAMA DE LO DATOS RECOLECTADOS**





**CALCULO DEL RANGO "D"**

Se depuran un total de 10% de los datos siendo 5% por cada extremo del histograma

Lado izquierdo	
Valor a dividir (di) =	3
Existente (ei) =	8
Faltante (fi) =	2

Lado derecho	
Valor a dividir (dd) =	6
Existente (ed) =	6
Faltante (fd) =	4

N° de intervalos

Rango medio (dm) = 12

Entonces "D" viene a ser:

$$D = \left( \frac{(d_i - f_i)}{d_i} + d_m + \frac{(d_d - f_d)}{d_d} \right) * 5 [mm]$$

D= 63.33 mm

**CÁLCULO FACTOR DE CORRECCIÓN fc:**

Donde:

Ep = 6.2  
 Li = 25  
 Lf = 15

$$f_c = \left( \frac{(E_p * 10)}{(L_i - L_f) * 5} \right)$$

fc = 1.24 mm

**CÁLCULO DEL RANGO CORREGIDO Dc:**

$$D_c = D * f_c$$

Dc = 78.53 mm

**DETERMINACIÓN DEL I.R.I.:**

Para pavimentos nuevos:

$$I.R.I. = 0.0485 * D_c$$

→ (IRI < 2.4)

Para pavimentos en servicio:

$$I.R.I. = 0.593 + 0.0471 * D_c$$

→ (2.4 < IRI < 15.9)

**CÁLCULO DEL I.R.I.:**

Aplicando la fórmula para pavimentos en servicio:

$$I.R.I. = 0.593 + 0.0471 * D_c$$

I.R.I. = 4.29 m/km



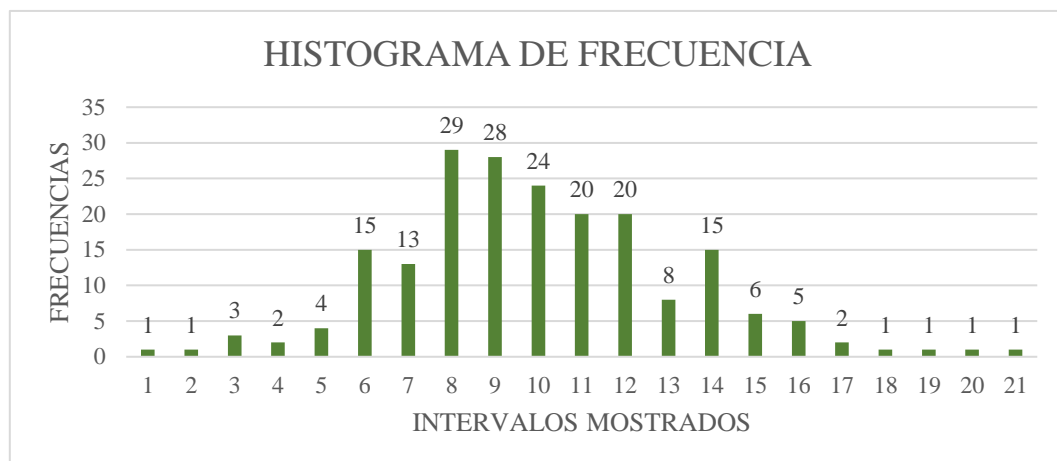
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**DPTO. DE TOPOGRAFIA Y VÍAS DE COMUNICACIÓN**  
**CARRERA DE INGENIERIA CIVIL**  
**LABORATORIO DE ASFALTOS**

**Nombre del tramo:** Av. Felipe Palazón (Rotonda Los Leones - Calle 10)

**Carril de ida** Progresiva: 0+400 a 0+800

	1	2	3	4	5	6	7	8	9	10
1	31.00	28.00	28.00	31.00	33.00	27.00	28.00	36.00	27.00	31.00
2	33.00	30.00	31.00	34.00	25.00	28.00	27.00	26.00	30.00	29.00
3	35.00	28.00	30.00	32.00	33.00	32.00	38.00	31.00	28.00	32.00
4	29.00	26.00	26.00	36.00	27.00	36.00	48.00	29.00	26.00	24.00
5	33.00	32.00	34.00	32.00	29.00	28.00	29.00	29.00	31.00	26.00
6	31.00	43.00	30.00	27.00	32.00	27.00	6.00	34.00	28.00	29.00
7	25.00	30.00	32.00	30.00	30.00	36.00	16.00	32.00	30.00	32.00
8	31.00	30.00	32.00	33.00	29.00	26.00	28.00	29.00	29.00	30.00
9	36.00	31.00	29.00	29.00	28.00	29.00	37.00	34.00	34.00	29.00
10	30.00	29.00	30.00	32.00	29.00	32.00	29.00	27.00	32.00	29.00
11	31.00	35.00	34.00	30.00	28.00	26.00	35.00	28.00	39.00	23.00
12	30.00	35.00	29.00	34.00	26.00	26.00	32.00	30.00	28.00	30.00
13	28.00	28.00	29.00	31.00	34.00	32.00	27.00	29.00	26.00	29.00
14	30.00	28.00	34.00	37.00	28.00	31.00	26.00	30.00	31.00	34.00
15	31.00	34.00	26.00	30.00	30.00	27.00	27.00	28.00	26.00	28.00
16	31.00	26.00	28.00	27.00	28.00	29.00	28.00	30.00	31.00	31.00
17	30.00	31.00	29.00	34.00	28.00	29.00	25.00	24.00	23.00	27.00
18	29.00	31.00	30.00	28.00	29.00	34.00	27.00	33.00	33.00	25.00
19	35.00	26.00	34.00	32.00	28.00	28.00	33.00	32.00	35.00	32.00
20	28.00	28.00	29.00	31.00	30.00	23.00	28.00	34.00	32.00	32.00

**HISTOGRAMA DE LO DATOS RECOLECTADOS**





**CALCULO DEL RANGO "D"**

Se depuran un total de 10% de los datos siendo 5% por cada extremo del histograma

Lado izquierdo	
Valor a dividir (di) =	<b>4</b>
Existente (ei) =	7
Faltante (fi) =	<b>3</b>

Lado derecho	
Valor a dividir (dd) =	<b>5</b>
Existente (ed) =	6
Faltante (fd) =	<b>4</b>

N° de intervalos

Rango medio (dm) = **10**

Entonces "D" viene a ser:

$$D = \left( \frac{(d_i - f_i)}{d_i} + d_m + \frac{(d_d - f_d)}{d_d} \right) * 5 [mm]$$

D= 52.25 mm

**CÁLCULO FACTOR DE CORRECCIÓN fc:**

Donde:

Ep = 6.2

Li = 25

Lf = 15

$$f_c = \left( \frac{(E_p * 10)}{(L_i - L_f) * 5} \right)$$

fc = 1.24 mm

**CÁLCULO DEL RANGO CORREGIDO Dc:**

Dc = D \* fc

Dc = 64.79 mm

**DETERMINACIÓN DEL I.R.I.:**

Para pavimentos nuevos:

I. R. I. = 0.0485 \* Dc

⇒ (IRI < 2.4)

Para pavimentos en servicio:

I. R. I. = 0.593 + 0.0471 \* Dc

⇒ (2.4 < IRI < 15.9)

**CÁLCULO DEL I.R.I.:**

Aplicando la fórmula para pavimentos en servicio:

I. R. I. = 0.593 + 0.0471 \* Dc

I.R.I. = 3.64 m/km



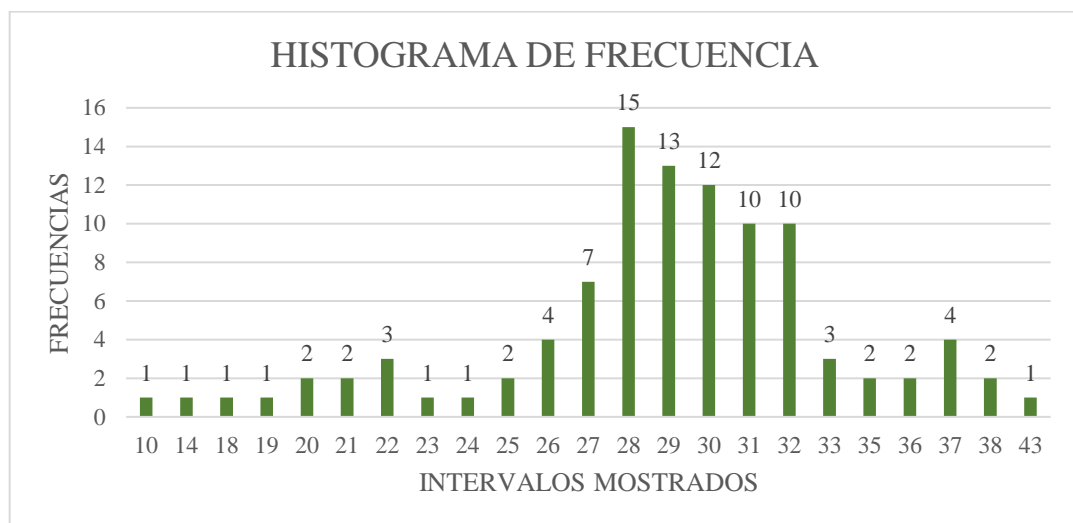
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**CARRERA DE INGENIERIA CIVIL**  
**LABORATORIO DE ASFALTOS**

**Nombre del tramo:** Av. Felipe Palazón (Rotonda Los Leones - Calle 10)

**Carril de ida** Progresiva: 0+800 a 1+000

	1	2	3	4	5	6	7	8	9	10
1	29.00	31.00	30.00	21.00	20.00	26.00	19.00	20.00	24.00	22.00
2	28.00	27.00	28.00	25.00	27.00	21.00	20.00	19.00	21.00	20.00
3	25.00	28.00	28.00	28.00	31.00	18.00	23.00	17.00	22.00	22.00
4	29.00	33.00	30.00	37.00	32.00	22.00	26.00	17.00	22.00	19.00
5	29.00	36.00	26.00	32.00	32.00	18.00	22.00	25.00	20.00	18.00
6	29.00	29.00	26.00	31.00	28.00	43.00	24.00	29.00	22.00	22.00
7	28.00	27.00	29.00	30.00	20.00	39.00	30.00	19.00	27.00	21.00
8	22.00	28.00	32.00	18.00	36.00	29.00	19.00	17.00	18.00	22.00
9	27.00	27.00	32.00	21.00	37.00	32.00	11.00	21.00	22.00	23.00
10	30.00	31.00	28.00	22.00	22.00	18.00	28.00	18.00	14.00	18.00
11	29.00	32.00	26.00	38.00	28.00	27.00	30.00	19.00	26.00	23.00
12	30.00	31.00	32.00	29.00	29.00	18.00	6.00	23.00	23.00	28.00
13	28.00	30.00	30.00	32.00	14.00	21.00	21.00	22.00	19.00	24.00
14	23.00	31.00	10.00	37.00	32.00	36.00	21.00	20.00	23.00	19.00
15	31.00	30.00	35.00	31.00	31.00	14.00	19.00	22.00	24.00	25.00
16	31.00	30.00	35.00	29.00	28.00	24.00	17.00	23.00	26.00	33.00
17	28.00	27.00	32.00	28.00	27.00	17.00	25.00	18.00	24.00	22.00
18	33.00	29.00	24.00	30.00	30.00	23.00	17.00	20.00	23.00	20.00
19	30.00	28.00	37.00	26.00	29.00	23.00	21.00	25.00	23.00	22.00
20	33.00	29.00	43.00	38.00	19.00	20.00	13.00	23.00	21.00	25.00

**HISTOGRAMA DE LO DATOS RECOLECTADOS**





**CALCULO DEL RANGO "D"**

Se depuran un total de 10% de los datos siendo 5% por cada extremo del histograma

Lado izquierdo	
Valor a dividir (di) =	<b>3</b>
Existente (ei) =	8
Faltante (fi) =	<b>2</b>

Lado derecho	
Valor a dividir (dd) =	<b>2</b>
Existente (ed) =	9
Faltante (fd) =	<b>1</b>

N° de intervalos

Rango medio (dm) = **11**

Entonces "D" viene a ser:

$$D = \left( \frac{(d_i - f_i)}{d_i} + d_m + \frac{(d_d - f_d)}{d_d} \right) * 5 [mm]$$

D= 59.17 mm

**CÁLCULO FACTOR DE CORRECCIÓN fc:**

Donde:

Ep = 6.2  
 Li = 25  
 Lf = 15

$$f_c = \left( \frac{(E_p * 10)}{(L_i - L_f) * 5} \right)$$

fc = 1.24 mm

**CÁLCULO DEL RANGO CORREGIDO Dc:**

$$D_c = D * f_c$$

Dc = 73.37 mm

**DETERMINACIÓN DEL I.R.I.:**

Para pavimentos nuevos:

$$I.R.I. = 0.0485 * D_c$$

→ (IRI < 2.4)

Para pavimentos en servicio:

$$I.R.I. = 0.593 + 0.0471 * D_c$$

→ (2.4 < IRI < 15.9)

**CÁLCULO DEL I.R.I.:**

Aplicando la fórmula para pavimentos en servicio:

$$I.R.I. = 0.593 + 0.0471 * D_c$$

**I.R.I. = 4.05 m/km**





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**DPTO. DE TOPOGRAFIA Y VÍAS DE COMUNICACIÓN**  
**CARRERA DE INGENIERIA CIVIL**  
**LABORATORIO DE ASFALTOS**

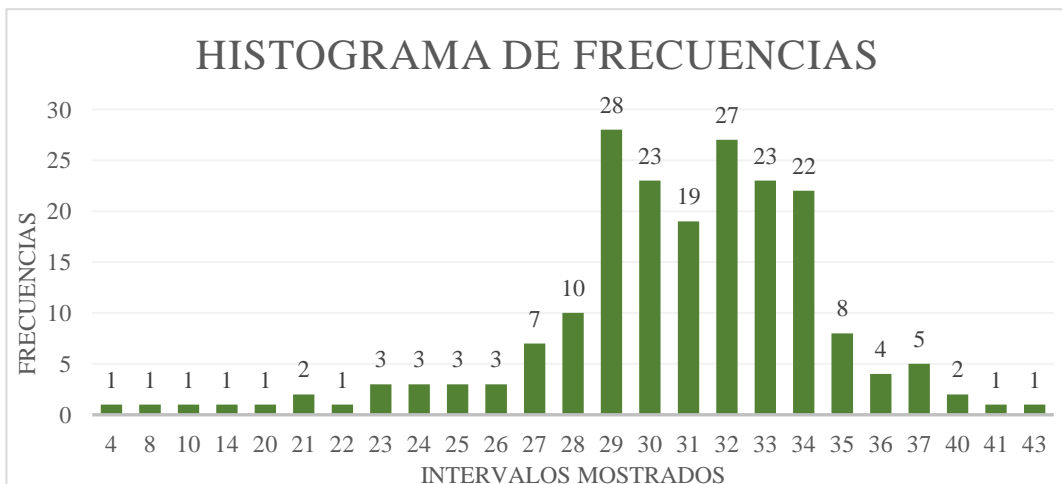
**Nombre del tramo:** Av. Felipe Palazón (Rotonda Los Leones - Calle 10)

**Carril de ida** Progresiva: 0+000 a 0+400

**Huella 2**

	1	2	3	4	5	6	7	9	10
1	29.00	33.00	29.00	34.00	33.00	30.00	36.00	35.00	24.00
2	23.00	26.00	29.00	34.00	32.00	33.00	28.00	31.00	35.00
3	34.00	40.00	29.00	32.00	31.00	31.00	35.00	32.00	33.00
4	23.00	27.00	29.00	30.00	28.00	30.00	36.00	32.00	29.00
5	37.00	30.00	10.00	32.00	28.00	29.00	33.00	31.00	23.00
6	32.00	33.00	43.00	31.00	28.00	29.00	27.00	31.00	33.00
7	35.00	32.00	34.00	30.00	33.00	30.00	27.00	34.00	37.00
8	33.00	32.00	34.00	32.00	29.00	30.00	33.00	29.00	33.00
9	32.00	28.00	8.00	32.00	29.00	32.00	34.00	25.00	28.00
10	28.00	29.00	29.00	31.00	32.00	30.00	30.00	31.00	37.00
11	31.00	29.00	29.00	32.00	30.00	33.00	30.00	27.00	25.00
12	28.00	35.00	40.00	29.00	31.00	34.00	33.00	29.00	30.00
13	26.00	33.00	21.00	30.00	32.00	34.00	29.00	29.00	30.00
14	31.00	30.00	22.00	32.00	36.00	34.00	30.00	29.00	26.00
15	32.00	31.00	34.00	33.00	33.00	31.00	30.00	30.00	34.00
16	37.00	31.00	29.00	33.00	32.00	24.00	29.00	31.00	34.00
17	21.00	34.00	31.00	36.00	33.00	24.00	27.00	34.00	32.00
18	35.00	29.00	27.00	35.00	34.00	34.00	27.00	32.00	34.00
19	33.00	29.00	30.00	25.00	33.00	28.00	34.00	32.00	37.00
20	35.00	34.00	30.00	20.00	33.00	4.00	34.00	14.00	29.00

**HISTOGRAMA DE LO DATOS RECOLECTADOS**





**CALCULO DEL RANGO "D"**

Se depuran un total de 10% de los datos siendo 5% por cada extremo del histograma

Lado izquierdo	
Valor a dividir (di) =	<b>3</b>
Existente (ei) =	8
Faltante (fi) =	<b>2</b>

Lado derecho	
Valor a dividir (dd) =	<b>4</b>
Existente (ed) =	9
Faltante (fd) =	<b>1</b>

N° de intervalos

Rango medio (dm) = **12**

Entonces "D" viene a ser:

$$D = \left( \frac{(d_i - f_i)}{d_i} + d_m + \frac{(d_d - f_d)}{d_d} \right) * 5 [mm]$$

$$D = 65.42 \text{ mm}$$

**CÁLCULO FACTOR DE CORRECCIÓN fc:**

Donde:

$$E_p = 6.2$$

$$L_i = 25$$

$$L_f = 15$$

$$f_c = \left( \frac{(E_p * 10)}{(L_i - L_f) * 5} \right)$$

$$f_c = 1.24 \text{ mm}$$

**CÁLCULO DEL RANGO CORREGIDO Dc:**

$$D_c = D * f_c$$

$$D_c = 81.12 \text{ mm}$$

**DETERMINACIÓN DEL I.R.I.:**

Para pavimentos nuevos:

$$I.R.I. = 0.0485 * D_c$$

$$\implies (IRI < 2.4)$$

Para pavimentos en servicio:

$$I.R.I. = 0.593 + 0.0471 * D_c$$

$$\implies (2.4 < IRI < 15.9)$$

**CÁLCULO DEL I.R.I.:**

Aplicando la fórmula para pavimentos en servicio:

$$I.R.I. = 0.593 + 0.0471 * D_c$$

$$I.R.I. = 4.41 \text{ m/km}$$



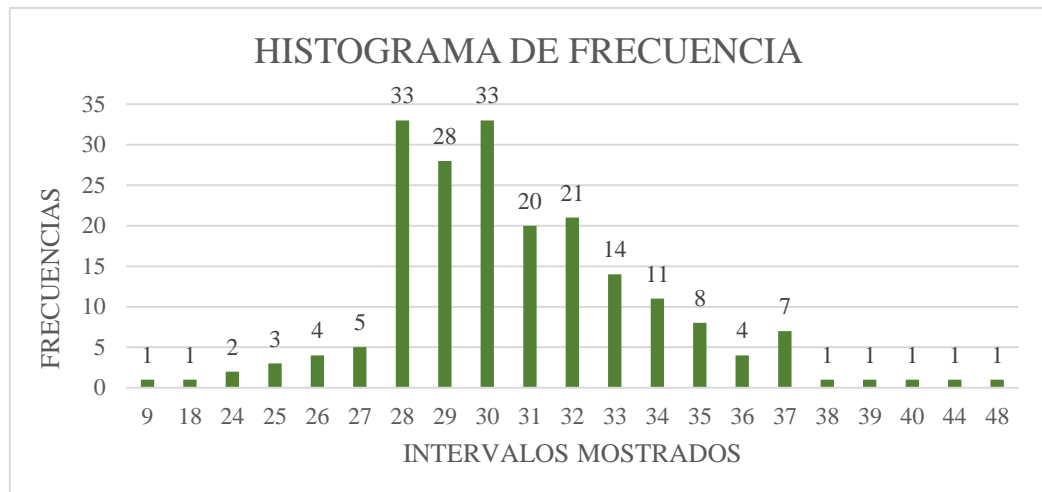
UNIVERSIDAD AUTÓNOMA JUAN MISAEL SARACHO  
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 DPTO. DE TOPOGRAFIA Y VÍAS DE COMUNICACIÓN  
 CARRERA DE INGENIERIA CIVIL  
 LABORATORIO DE ASFALTOS

Nombre del tramo: Av. Felipe Palazón (Rotonda Los Leones - Calle 10)

Carril de ida Progresiva: 0+400 a 0+800

	1	2	3	4	5	6	7	8	9	10
1	32.00	29.00	28.00	31.00	33.00	29.00	29.00	37.00	29.00	32.00
2	33.00	31.00	31.00	34.00	27.00	30.00	29.00	28.00	30.00	29.00
3	36.00	29.00	31.00	33.00	33.00	32.00	38.00	31.00	28.00	32.00
4	31.00	28.00	28.00	37.00	29.00	37.00	48.00	30.00	28.00	27.00
5	33.00	33.00	34.00	39.00	30.00	30.00	30.00	30.00	32.00	26.00
6	32.00	44.00	31.00	28.00	33.00	29.00	9.00	34.00	28.00	30.00
7	25.00	30.00	32.00	25.00	30.00	31.00	18.00	32.00	30.00	32.00
8	32.00	30.00	32.00	33.00	28.00	29.00	28.00	30.00	28.00	30.00
9	37.00	32.00	30.00	30.00	28.00	29.00	37.00	34.00	34.00	29.00
10	30.00	30.00	30.00	32.00	28.00	32.00	30.00	28.00	35.00	29.00
11	31.00	36.00	34.00	30.00	28.00	28.00	35.00	28.00	40.00	24.00
12	30.00	36.00	30.00	35.00	28.00	28.00	33.00	30.00	28.00	31.00
13	29.00	28.00	30.00	32.00	35.00	32.00	27.00	29.00	28.00	31.00
14	30.00	28.00	35.00	37.00	29.00	31.00	26.00	30.00	31.00	34.00
15	31.00	34.00	28.00	30.00	30.00	28.00	28.00	28.00	26.00	28.00
16	31.00	28.00	28.00	29.00	29.00	29.00	28.00	31.00	31.00	31.00
17	31.00	32.00	30.00	35.00	29.00	29.00	27.00	25.00	24.00	29.00
18	29.00	32.00	30.00	29.00	29.00	34.00	27.00	33.00	33.00	26.00
19	36.00	28.00	35.00	32.00	29.00	30.00	34.00	33.00	35.00	32.00
20	37.00	28.00	29.00	32.00	31.00	30.00	29.00	34.00	33.00	33.00

HISTOGRAMA DE LO DATOS RECOLECTADOS





**CALCULO DEL RANGO "D"**

Se depuran un total de 10% de los datos siendo 5% por cada extremo del histograma

Lado izquierdo	
Valor a dividir (di) =	<b>4</b>
Existente (ei) =	7
Faltante (fi) =	<b>3</b>

Lado derecho	
Valor a dividir (dd) =	<b>7</b>
Existente (ed) =	5
Faltante (fd) =	<b>5</b>

N° de intervalos

Rango medio (dm) = **10**

Entonces "D" viene a ser:

$$D = \left( \frac{(d_i - f_i)}{d_i} + d_m + \frac{(d_d - f_d)}{d_d} \right) * 5 [mm]$$

D= 52.68 mm

**CÁLCULO FACTOR DE CORRECCIÓN fc:**

Donde:

Ep = 6.2  
 Li = 25  
 Lf = 15

$$f_c = \left( \frac{(E_p * 10)}{(L_i - L_f) * 5} \right)$$

fc = 1.24 mm

**CÁLCULO DEL RANGO CORREGIDO Dc:**

$$D_c = D * f_c$$

Dc = 65.32 mm

**DETERMINACIÓN DEL I.R.I.:**

Para pavimentos nuevos:

I. R. I. = 0.0485 \* Dc      ⇒      (IRI < 2.4)

Para pavimentos en servicio:

I. R. I. = 0.593 + 0.0471 \* Dc      ⇒      (2.4 < IRI < 15.9)

**CÁLCULO DEL I.R.I.:**

Aplicando la fórmula para pavimentos en servicio:

I. R. I. = 0.593 + 0.0471 \* Dc

**I.R.I. = 3.67 m/km**



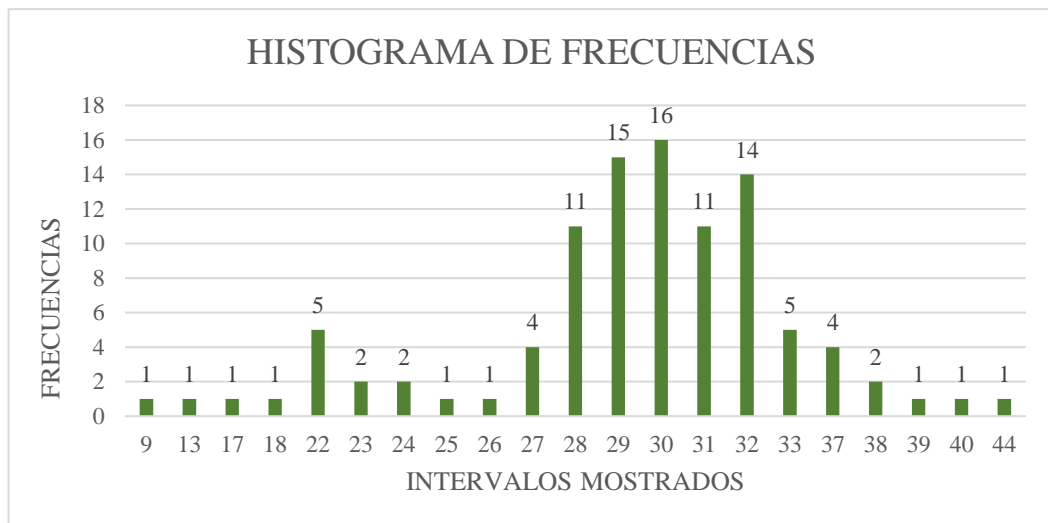
**UNIVERSIDAD AUTÓNOMA JUAN MISAEL SARACHO**  
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**CARRERA DE INGENIERIA CIVIL**  
**LABORATORIO DE ASFALTOS**

**Nombre del tramo:** Av. Felipe Palazón (Rotonda Los Leones - Calle 10)

**Carril de ida** Progresiva: 0+800 a 1+000

	1	2	3	4	5	6	7	8	9	10
1	30.00	32.00	31.00	22.00	22.00	28.00	20.00	20.00	23.00	21.00
2	30.00	27.00	29.00	28.00	29.00	22.00	20.00	20.00	19.00	21.00
3	27.00	30.00	29.00	28.00	31.00	18.00	24.00	17.00	22.00	22.00
4	29.00	33.00	30.00	37.00	32.00	23.00	26.00	17.00	22.00	18.00
5	29.00	37.00	28.00	32.00	32.00	17.00	23.00	26.00	20.00	18.00
6	29.00	28.00	28.00	32.00	29.00	44.00	24.00	31.00	23.00	22.00
7	30.00	27.00	30.00	30.00	22.00	40.00	31.00	20.00	27.00	22.00
8	23.00	29.00	33.00	17.00	38.00	30.00	19.00	16.00	19.00	22.00
9	24.00	30.00	33.00	22.00	37.00	33.00	10.00	20.00	20.00	23.00
10	30.00	31.00	28.00	22.00	23.00	19.00	30.00	18.00	14.00	17.00
11	31.00	32.00	28.00	40.00	29.00	30.00	31.00	18.00	25.00	24.00
12	31.00	31.00	32.00	30.00	29.00	19.00	7.00	23.00	25.00	27.00
13	25.00	30.00	30.00	32.00	13.00	23.00	20.00	21.00	20.00	24.00
14	24.00	31.00	9.00	38.00	32.00	38.00	20.00	20.00	23.00	18.00
15	31.00	31.00	33.00	32.00	32.00	13.00	18.00	22.00	23.00	25.00
16	31.00	31.00	30.00	29.00	28.00	24.00	17.00	22.00	26.00	34.00
17	29.00	27.00	32.00	29.00	28.00	16.00	26.00	19.00	26.00	22.00
18	33.00	26.00	28.00	30.00	30.00	24.00	17.00	21.00	23.00	20.00
19	32.00	29.00	37.00	28.00	30.00	24.00	22.00	25.00	23.00	25.00
20	32.00	29.00	44.00	39.00	18.00	21.00	12.00	24.00	23.00	25.00

**HISTOGRAMA DE LO DATOS RECOLECTADOS**





**CALCULO DEL RANGO "D"**

Se depuran un total de 10% de los datos siendo 5% por cada extremo del histograma

Lado izquierdo	
Valor a dividir (di) =	<b>2</b>
Existente (ei) =	9
Faltante (fi) =	<b>1</b>

Lado derecho	
Valor a dividir (dd) =	<b>5</b>
Existente (ed) =	9
Faltante (fd) =	<b>1</b>

N° de intervalos

Rango medio (dm) = **9**

Entonces "D" viene a ser:

$$D = \left( \frac{(d_i - f_i)}{d_i} + d_m + \frac{(d_a - f_a)}{d_a} \right) * 5 [mm]$$

D= 51.5 mm

**CÁLCULO FACTOR DE CORRECCIÓN fc:**

Donde:

- Ep = 6.2
- Li = 25
- Lf = 15

$$f_c = \left( \frac{(E_p * 10)}{(L_i - L_f) * 5} \right)$$

fc = 1.24 mm

**CÁLCULO DEL RANGO CORREGIDO Dc:**

$$D_c = D * f_c$$

Dc = 63.86 mm

**DETERMINACIÓN DEL I.R.I.:**

Para pavimentos nuevos:

I. R. I. = 0.0485 \* D<sub>c</sub> → (IRI < 2.4)

Para pavimentos en servicio:

I. R. I. = 0.593 + 0.0471 \* D<sub>c</sub> → (2.4 < IRI < 15.9)

**CÁLCULO DEL I.R.I.:**

Aplicando la fórmula para pavimentos en servicio:

I. R. I. = 0.593 + 0.0471 \* D<sub>c</sub>

**I.R.I.= 3.60 m/km**



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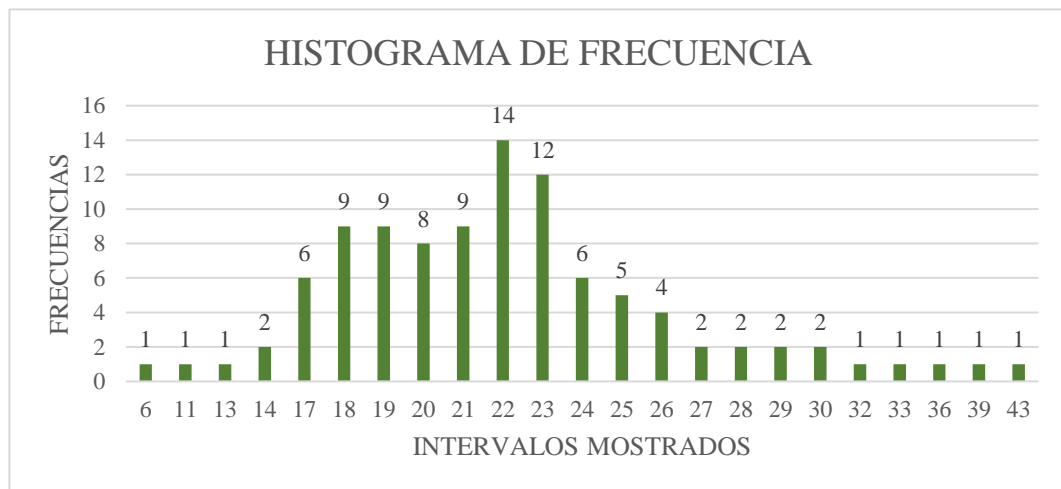
**Nombre del tramo:** Av. Felipe Palazón (Rotonda Los Leones - Calle 10)

**Carril de vuelta** Progresiva: 1+000 a 0+800

**Huella 1**

	1	2	3	4	5	6	7	8	9	10
1	29.00	31.00	30.00	21.00	20.00	26.00	19.00	20.00	24.00	22.00
2	28.00	27.00	28.00	25.00	27.00	21.00	20.00	19.00	21.00	20.00
3	25.00	28.00	28.00	28.00	31.00	18.00	23.00	17.00	22.00	22.00
4	29.00	33.00	30.00	37.00	32.00	22.00	26.00	17.00	22.00	19.00
5	29.00	36.00	26.00	32.00	32.00	18.00	22.00	25.00	20.00	18.00
6	29.00	29.00	26.00	31.00	28.00	43.00	24.00	29.00	22.00	22.00
7	28.00	27.00	29.00	30.00	20.00	39.00	30.00	19.00	27.00	21.00
8	22.00	28.00	32.00	18.00	36.00	29.00	19.00	17.00	18.00	22.00
9	27.00	27.00	32.00	21.00	37.00	32.00	11.00	21.00	22.00	23.00
10	30.00	31.00	28.00	22.00	22.00	18.00	28.00	18.00	14.00	18.00
11	29.00	32.00	26.00	38.00	28.00	27.00	30.00	19.00	26.00	23.00
12	30.00	31.00	32.00	29.00	29.00	18.00	6.00	23.00	23.00	28.00
13	28.00	30.00	30.00	32.00	14.00	21.00	21.00	22.00	19.00	24.00
14	23.00	31.00	10.00	37.00	32.00	36.00	21.00	20.00	23.00	19.00
15	31.00	30.00	35.00	31.00	31.00	14.00	19.00	22.00	24.00	25.00
16	31.00	30.00	35.00	29.00	28.00	24.00	17.00	23.00	26.00	33.00
17	28.00	27.00	32.00	28.00	27.00	17.00	25.00	18.00	24.00	22.00
18	33.00	29.00	24.00	30.00	30.00	23.00	17.00	20.00	23.00	20.00
19	30.00	28.00	37.00	26.00	29.00	23.00	21.00	25.00	23.00	22.00
20	33.00	29.00	43.00	38.00	19.00	20.00	13.00	23.00	21.00	25.00

**HISTOGRAMA DE LO DATOS RECOLECTADOS**





**CALCULO DEL RANGO "D"**

Se depuran un total de 10% de los datos siendo 5% por cada extremo del histograma

Lado izquierdo	
Valor a dividir (di) =	6
Existente (ei) =	5
Faltante (fi) =	5

Lado derecho	
Valor a dividir (dd) =	2
Existente (ed) =	9
Faltante (fd) =	1

N° de intervalos

Rango medio (dm) = 10

Entonces "D" viene a ser:

$$D = \left( \frac{(d_i - f_i)}{d_i} + d_m + \frac{(d_a - f_a)}{d_a} \right) * 5 [mm]$$

D= 53.33 mm

**CÁLCULO FACTOR DE CORRECCIÓN fc:**

Donde:

Ep = 6.2

Li = 25

Lf = 15

$$f_c = \left( \frac{(E_p * 10)}{(L_i - L_f) * 5} \right)$$

fc = 1.24 mm

**CÁLCULO DEL RANGO CORREGIDO Dc:**

Dc = D \* fc

Dc = 66.13 mm

**DETERMINACIÓN DEL I.R.I.:**

Para pavimentos nuevos:

I. R. I. = 0.0485 \* Dc

→ (IRI < 2.4)

Para pavimentos en servicio:

I. R. I. = 0.593 + 0.0471 \* Dc

→ (2.4 < IRI < 15.9)

**CÁLCULO DEL I.R.I.:**

Aplicando la fórmula para pavimentos en servicio:

I. R. I. = 0.593 + 0.0471 \* Dc

I.R.I. = 3.71 m/km





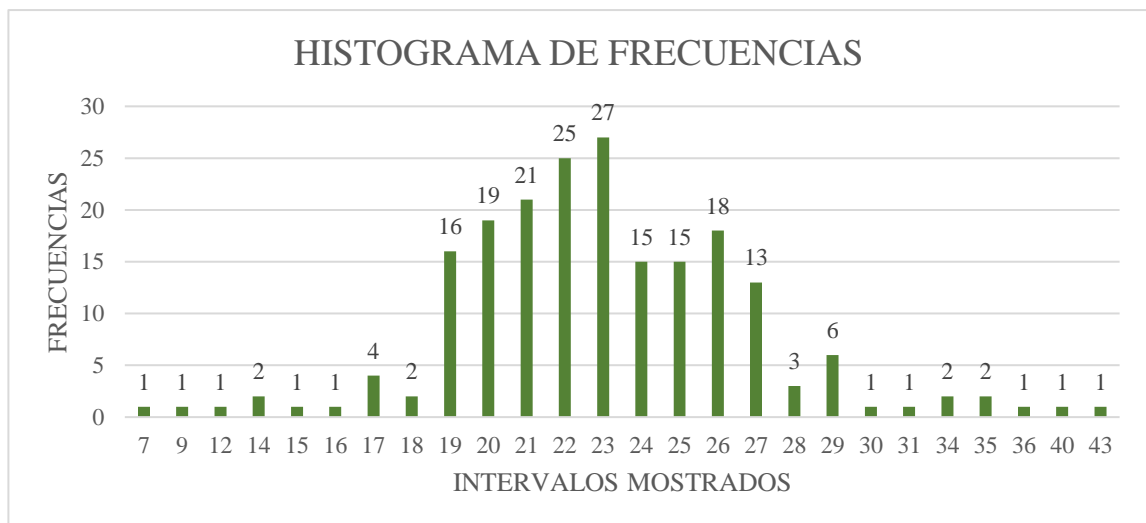
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 LABORATORIO DE ASFALTOS

Nombre del tramo: Av. Felipe Palazón (Rotonda Los Leones - Calle 10)

Carril de vuelta Progresiva: 0+800 a 0+400

	1	2	3	4	5	6	7	8	9	10
1	24.00	22.00	26.00	20.00	29.00	23.00	21.00	12.00	25.00	17.00
2	23.00	21.00	22.00	21.00	25.00	25.00	23.00	23.00	23.00	16.00
3	20.00	20.00	40.00	28.00	22.00	26.00	25.00	20.00	25.00	23.00
4	21.00	21.00	7.00	20.00	23.00	20.00	21.00	26.00	22.00	31.00
5	24.00	22.00	24.00	25.00	19.00	26.00	21.00	29.00	23.00	22.00
6	19.00	27.00	24.00	22.00	21.00	24.00	20.00	24.00	26.00	17.00
7	22.00	19.00	20.00	21.00	19.00	27.00	26.00	23.00	24.00	24.00
8	22.00	23.00	22.00	25.00	25.00	22.00	25.00	25.00	14.00	27.00
9	22.00	24.00	27.00	22.00	22.00	26.00	20.00	20.00	27.00	19.00
10	19.00	22.00	20.00	26.00	21.00	22.00	24.00	23.00	23.00	20.00
11	23.00	19.00	24.00	24.00	21.00	18.00	23.00	21.00	25.00	26.00
12	19.00	43.00	23.00	20.00	24.00	19.00	24.00	23.00	23.00	21.00
13	20.00	35.00	23.00	21.00	19.00	26.00	19.00	26.00	26.00	27.00
14	26.00	23.00	21.00	14.00	27.00	21.00	29.00	23.00	26.00	19.00
15	21.00	23.00	22.00	15.00	23.00	25.00	20.00	23.00	22.00	27.00
16	20.00	21.00	26.00	27.00	23.00	20.00	27.00	26.00	25.00	26.00
17	21.00	34.00	27.00	17.00	22.00	19.00	20.00	21.00	22.00	22.00
18	20.00	29.00	28.00	36.00	18.00	22.00	29.00	21.00	9.00	29.00
19	19.00	30.00	23.00	27.00	24.00	19.00	27.00	23.00	35.00	26.00
20	23.00	17.00	22.00	22.00	25.00	25.00	34.00	22.00	28.00	19.00

HISTOGRAMA DE LO DATOS RECOLECTADOS





**CALCULO DEL RANGO "D"**

Se depuran un total de 10% de los datos siendo 5% por cada extremo del histograma

<b>Lado izquierdo</b>	
Valor a dividir (di) =	<b>4</b>
Existente (ei) =	7
Faltante (fi) =	<b>3</b>

<b>Lado derecho</b>	
Valor a dividir (dd) =	<b>6</b>
Existente (ed) =	9
Faltante (fd) =	<b>1</b>

N° de intervalos

Rango medio (dm) = **11**

Entonces "D" viene a ser:

$$D = \left( \frac{(d_i - f_i)}{d_i} + d_m + \frac{(d_d - f_d)}{d_d} \right) * 5 [mm]$$

D= 60.42 mm

**CÁLCULO FACTOR DE CORRECCIÓN fc:**

Donde:

- Ep = 6.2
- Li = 25
- Lf = 15

$$f_c = \left( \frac{(E_p * 10)}{(L_i - L_f) * 5} \right)$$

fc = 1.24 mm

**CÁLCULO DEL RANGO CORREGIDO Dc:**

$$D_c = D * f_c$$

Dc = 74.92 mm

**DETERMINACIÓN DEL I.R.I.:**

Para pavimentos nuevos:

I. R. I. = 0.0485 \* D<sub>c</sub>



(IRI<2.4)

Para pavimentos en servicio:

I. R. I. = 0.593 + 0.0471 \* D<sub>c</sub>



(2.4<IRI<15.9)

**CÁLCULO DEL I.R.I.:**

Aplicando la fórmula para pavimentos en servicio:

I. R. I. = 0.593 + 0.0471 \* D<sub>c</sub>

**I.R.I.= 4.12 m/km**



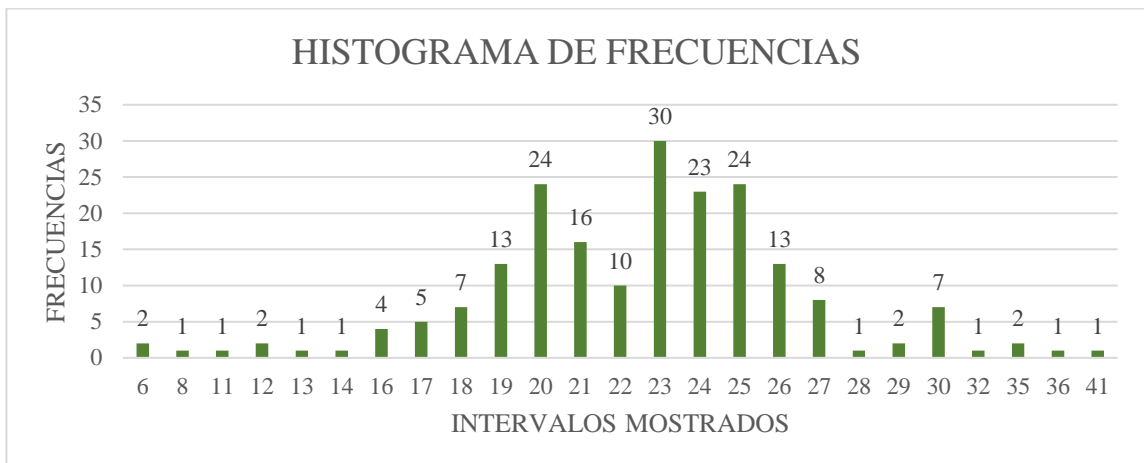
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**FACULTAD CIENCIAS Y TECNOLOGÍA**  
**DPTO. DE TOPOGRAFIA Y VÍAS DE COMUNICACIÓN**  
**CARRERA DE INGENIERIA CIVIL**  
**LABORATORIO DE ASFALTOS**

**Nombre del tramo:** Av. Felipe Palazón (Rotonda Los Leones - Calle 10)

**Carril de vuelta** Progresiva: 0+400 a 0+000

	1	2	3	4	5	6	7	8	9	10
1	26.00	25.00	23.00	30.00	23.00	24.00	25.00	21.00	29.00	29.00
2	19.00	19.00	27.00	28.00	27.00	24.00	20.00	18.00	26.00	21.00
3	23.00	18.00	25.00	23.00	21.00	23.00	23.00	21.00	26.00	17.00
4	21.00	23.00	21.00	22.00	23.00	22.00	20.00	24.00	25.00	20.00
5	25.00	20.00	23.00	20.00	25.00	24.00	25.00	20.00	26.00	20.00
6	32.00	8.00	23.00	24.00	23.00	24.00	20.00	22.00	20.00	19.00
7	23.00	27.00	22.00	19.00	20.00	23.00	23.00	19.00	27.00	30.00
8	26.00	17.00	16.00	22.00	26.00	25.00	18.00	26.00	24.00	16.00
9	25.00	25.00	12.00	20.00	25.00	19.00	26.00	23.00	24.00	17.00
10	20.00	25.00	21.00	23.00	20.00	25.00	35.00	22.00	19.00	21.00
11	12.00	22.00	25.00	21.00	20.00	20.00	19.00	18.00	21.00	20.00
12	6.00	25.00	24.00	23.00	24.00	27.00	23.00	25.00	20.00	6.00
13	16.00	19.00	21.00	26.00	23.00	24.00	22.00	41.00	23.00	30.00
14	30.00	21.00	25.00	17.00	23.00	24.00	18.00	21.00	26.00	27.00
15	26.00	24.00	24.00	25.00	26.00	23.00	20.00	25.00	19.00	18.00
16	23.00	24.00	24.00	25.00	23.00	22.00	21.00	20.00	23.00	23.00
17	24.00	20.00	24.00	20.00	25.00	21.00	24.00	20.00	20.00	25.00
18	24.00	19.00	24.00	23.00	19.00	25.00	23.00	30.00	17.00	27.00
19	36.00	24.00	18.00	30.00	11.00	26.00	21.00	14.00	13.00	20.00
20	16.00	30.00	25.00	27.00	22.00	24.00	35.00	19.00	23.00	23.00

**HISTOGRAMA DE LO DATOS RECOLECTADOS**





**CALCULO DEL RANGO "D"**

Se depuran un total de 10% de los datos siendo 5% por cada extremo del histograma

Lado izquierdo	
Valor a dividir (di) =	4
Existente (ei) =	8
Faltante (fi) =	2

Lado derecho	
Valor a dividir (dd) =	7
Existente (ed) =	5
Faltante (fd) =	5

N° de intervalos

Rango medio (dm) = 13

Entonces "D" viene a ser:

$$D = \left( \frac{(d_i - f_i)}{d_i} + d_m + \frac{(d_d - f_d)}{d_d} \right) * 5 [mm]$$

D=68.93 mm

**CÁLCULO FACTOR DE CORRECCIÓN fc:**

Donde:

- Ep = 6.2
- Li = 25
- Lf = 15

$$f_c = \left( \frac{(E_p * 10)}{(L_i - L_f) * 5} \right)$$

fc = 1.24 mm

**CÁLCULO DEL RANGO CORREGIDO Dc:**

$$D_c = D * f_c$$

Dc = 85.47 mm

**DETERMINACIÓN DEL I.R.I.:**

Para pavimentos nuevos:

I. R. I. = 0.0485 \* Dc → (IRI < 2.4)

Para pavimentos en servicio:

I. R. I. = 0.593 + 0.0471 \* Dc → (2.4 < IRI < 15.9)

**CÁLCULO DEL I.R.I.:**

Aplicando la fórmula para pavimentos en servicio:

I. R. I. = 0.593 + 0.0471 \* Dc  
**I.R.I. = 4.62 m/km**



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**CARRERA DE INGENIERIA CIVIL**  
**LABORATORIO DE ASFALTOS**

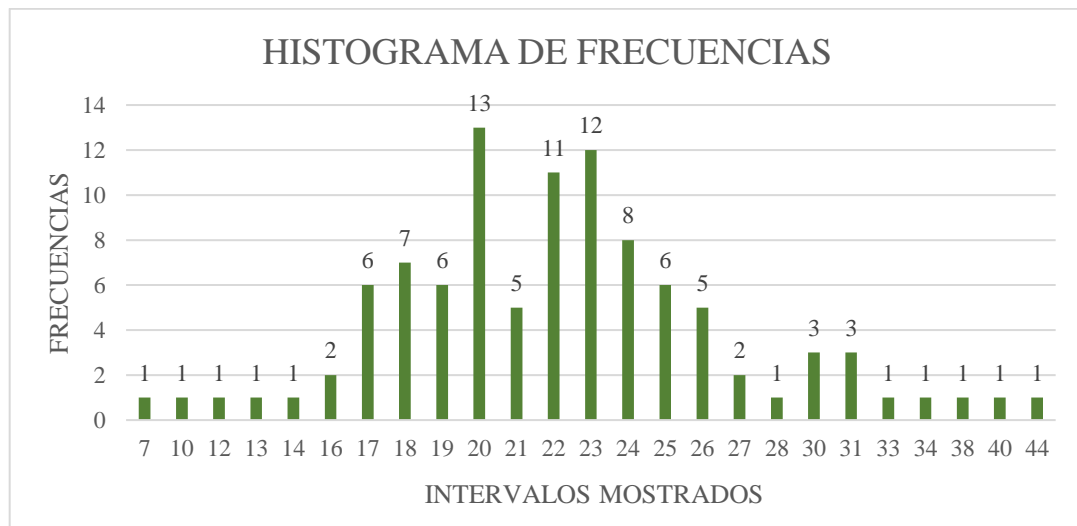
**Nombre del tramo:** Av. Felipe Palazón (Rotonda Los Leones - Calle 10)

**Carril de vuelta** Progresiva: 1+000 a 0+800

**Huella 2**

	1	2	3	4	5	6	7	8	9	10
1	30.00	32.00	31.00	22.00	22.00	28.00	20.00	20.00	23.00	21.00
2	30.00	27.00	29.00	28.00	29.00	22.00	20.00	20.00	19.00	21.00
3	27.00	30.00	29.00	28.00	31.00	18.00	24.00	17.00	22.00	22.00
4	29.00	33.00	30.00	37.00	32.00	23.00	26.00	17.00	22.00	18.00
5	29.00	37.00	28.00	32.00	32.00	17.00	23.00	26.00	20.00	18.00
6	29.00	28.00	28.00	32.00	29.00	44.00	24.00	31.00	23.00	22.00
7	30.00	27.00	30.00	30.00	22.00	40.00	31.00	20.00	27.00	22.00
8	23.00	29.00	33.00	17.00	38.00	30.00	19.00	16.00	19.00	22.00
9	24.00	30.00	33.00	22.00	37.00	33.00	10.00	20.00	20.00	23.00
10	30.00	31.00	28.00	22.00	23.00	19.00	30.00	18.00	14.00	17.00
11	31.00	32.00	28.00	40.00	29.00	30.00	31.00	18.00	25.00	24.00
12	31.00	31.00	32.00	30.00	29.00	19.00	7.00	23.00	25.00	27.00
13	25.00	30.00	30.00	32.00	13.00	23.00	20.00	21.00	20.00	24.00
14	24.00	31.00	9.00	38.00	32.00	38.00	20.00	20.00	23.00	18.00
15	31.00	31.00	33.00	32.00	32.00	13.00	18.00	22.00	23.00	25.00
16	31.00	31.00	30.00	29.00	28.00	24.00	17.00	22.00	26.00	34.00
17	29.00	27.00	32.00	29.00	28.00	16.00	26.00	19.00	26.00	22.00
18	33.00	26.00	28.00	30.00	30.00	24.00	17.00	21.00	23.00	20.00
19	32.00	29.00	37.00	28.00	30.00	24.00	22.00	25.00	23.00	25.00
20	32.00	29.00	44.00	39.00	18.00	21.00	12.00	24.00	23.00	25.00

**HISTOGRAMA DE LO DATOS RECOLECTADOS**





**CALCULO DEL RANGO "D"**

Se depuran un total de 10% de los datos siendo 5% por cada extremo del histograma

Lado izquierdo	
Valor a dividir (di) =	<b>6</b>
Existente (ei) =	7
Faltante (fi) =	<b>3</b>

Lado derecho	
Valor a dividir (dd) =	<b>3</b>
Existente (ed) =	8
Faltante (fd) =	<b>2</b>

N° de intervalos

Rango medio (dm) = **11**

Entonces "D" viene a ser:

$$D = \left( \frac{(d_i - f_i)}{d_i} + d_m + \frac{(d_d - f_d)}{d_d} \right) * 5 [mm]$$

$$D = 59.17 \text{ mm}$$

**CÁLCULO FACTOR DE CORRECCIÓN fc:**

Donde:

$$E_p = 6.2$$

$$L_i = 25$$

$$L_f = 15$$

$$f_c = \left( \frac{(E_p * 10)}{(L_i - L_f) * 5} \right)$$

$$f_c = 1.24 \text{ mm}$$

**CÁLCULO DEL RANGO CORREGIDO Dc:**

$$D_c = D * f_c$$

$$D_c = 73.37 \text{ mm}$$

**DETERMINACIÓN DEL I.R.I.:**

Para pavimentos nuevos:

$$I.R.I. = 0.0485 * D_c$$

$$(IRI < 2.4)$$

Para pavimentos en servicio:

$$I.R.I. = 0.593 + 0.0471 * D_c$$

$$(2.4 < IRI < 15.9)$$

**CÁLCULO DEL I.R.I.:**

Aplicando la fórmula para pavimentos en servicio:

$$I.R.I. = 0.593 + 0.0471 * D_c$$

$$I.R.I. = 4.05 \text{ m/km}$$



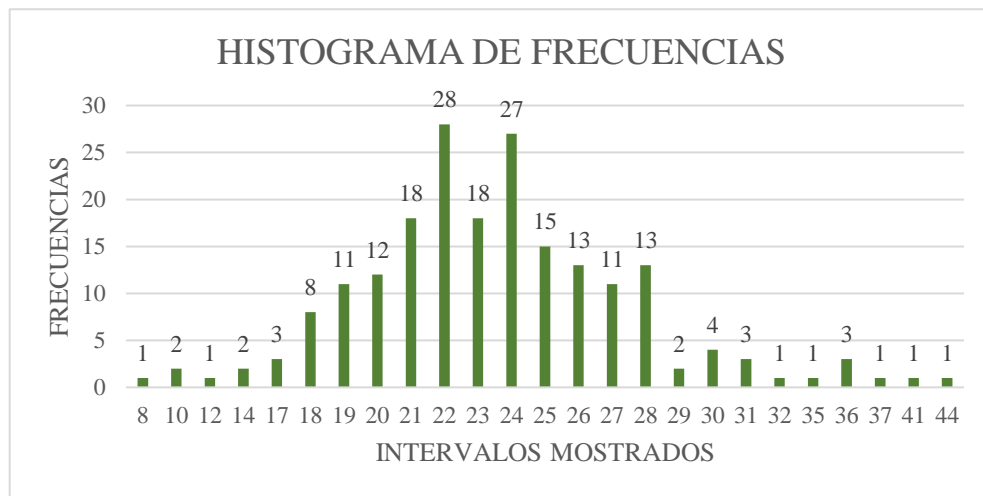
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 CARRERA DE INGENIERIA CIVIL  
 LABORATORIO DE ASFALTOS

Nombre del tramo: Av. Felipe Palazón (Rotonda Los Leones - Calle 10)

Carril de vuelta Progresiva: 0+800 a 0+400

	1	2	3	4	5	6	7	8	9	10
1	25.00	22.00	22.00	19.00	30.00	24.00	22.00	10.00	26.00	17.00
2	24.00	22.00	22.00	28.00	22.00	27.00	22.00	23.00	27.00	17.00
3	21.00	20.00	41.00	28.00	22.00	26.00	25.00	20.00	25.00	24.00
4	21.00	22.00	8.00	21.00	24.00	22.00	21.00	28.00	25.00	32.00
5	25.00	22.00	25.00	26.00	18.00	28.00	21.00	31.00	23.00	22.00
6	18.00	28.00	25.00	22.00	22.00	24.00	19.00	24.00	27.00	17.00
7	23.00	20.00	20.00	21.00	19.00	23.00	26.00	23.00	24.00	26.00
8	23.00	23.00	27.00	22.00	22.00	22.00	26.00	25.00	12.00	27.00
9	23.00	24.00	27.00	22.00	22.00	28.00	23.00	21.00	28.00	18.00
10	19.00	24.00	21.00	26.00	24.00	22.00	24.00	24.00	23.00	20.00
11	24.00	19.00	24.00	25.00	24.00	19.00	26.00	21.00	24.00	22.00
12	19.00	44.00	24.00	21.00	24.00	19.00	26.00	24.00	23.00	21.00
13	20.00	36.00	24.00	21.00	19.00	26.00	19.00	26.00	25.00	27.00
14	20.00	23.00	22.00	14.00	28.00	24.00	30.00	24.00	25.00	18.00
15	21.00	21.00	22.00	14.00	23.00	25.00	22.00	24.00	22.00	27.00
16	21.00	21.00	28.00	26.00	23.00	21.00	27.00	27.00	25.00	27.00
17	21.00	35.00	28.00	20.00	24.00	19.00	28.00	20.00	24.00	22.00
18	20.00	29.00	28.00	37.00	18.00	22.00	30.00	20.00	10.00	31.00
19	18.00	31.00	24.00	29.00	25.00	20.00	28.00	23.00	36.00	24.00
20	23.00	18.00	22.00	23.00	25.00	26.00	36.00	23.00	30.00	18.00

### HISTOGRAMA DE LO DATOS RECOLECTADOS





**CALCULO DEL RANGO "D"**

Se depuran un total de 10% de los datos siendo 5% por cada extremo del histograma

Lado izquierdo	
Valor a dividir (di) =	<b>8</b>
Existente (ei) =	9
Faltante (fi) =	<b>1</b>

Lado derecho	
Valor a dividir (dd) =	<b>3</b>
Existente (ed) =	8
Faltante (fd) =	<b>2</b>

N° de intervalos

Rango medio (dm) = **12**

Entonces "D" viene a ser:

$$D = \left( \frac{(d_i - f_i)}{d_i} + d_m + \frac{(d_d - f_d)}{d_d} \right) * 5 [mm]$$

D= 66.04 mm

**CÁLCULO FACTOR DE CORRECCIÓN fc:**

Donde:

Ep = 6.2

Li = 25

Lf = 15

$$f_c = \left( \frac{(E_p * 10)}{(L_i - L_f) * 5} \right)$$

fc = 1.24 mm

**CÁLCULO DEL RANGO CORREGIDO Dc:**

Dc = D \* fc

Dc = 81.89 mm

**DETERMINACIÓN DEL I.R.I.:**

Para pavimentos nuevos:

I. R. I. = 0.0485 \* Dc

→ (IRI<2.4)

Para pavimentos en servicio:

I. R. I. = 0.593 + 0.0471 \* Dc

→ (2.4<IRI<15.9)

**CÁLCULO DEL I.R.I.:**

Aplicando la fórmula para pavimentos en servicio:

I. R. I. = 0.593 + 0.0471 \* Dc

**I.R.I.= 4.45 m/km**





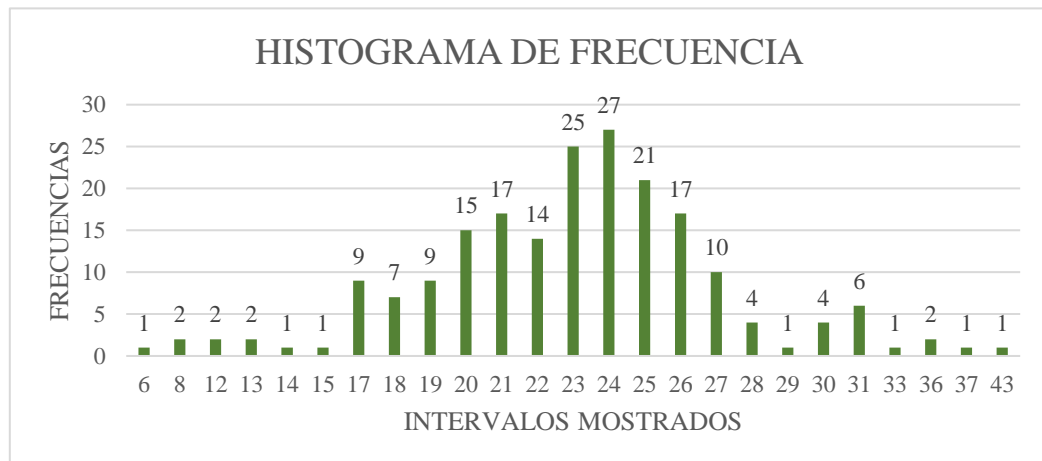
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**CARRERA DE INGENIERIA CIVIL**  
**LABORATORIO DE ASFALTOS**

**Nombre del tramo:** Av. Felipe Palazón (Rotonda Los Leones - Calle 10)

**Carril de vuelta** Progresiva: 0+400 a 0+000

	1	2	3	4	5	6	7	8	9	10
1	27.00	26.00	24.00	31.00	24.00	26.00	26.00	23.00	30.00	30.00
2	18.00	17.00	28.00	29.00	27.00	25.00	21.00	20.00	27.00	22.00
3	21.00	17.00	26.00	23.00	25.00	23.00	23.00	21.00	27.00	17.00
4	21.00	23.00	23.00	22.00	23.00	23.00	23.00	25.00	25.00	21.00
5	25.00	21.00	23.00	20.00	23.00	24.00	25.00	22.00	25.00	21.00
6	33.00	6.00	23.00	24.00	23.00	24.00	25.00	22.00	20.00	20.00
7	24.00	27.00	24.00	18.00	22.00	23.00	23.00	20.00	26.00	30.00
8	27.00	18.00	18.00	22.00	26.00	22.00	19.00	26.00	24.00	15.00
9	27.00	25.00	12.00	20.00	26.00	19.00	30.00	23.00	24.00	17.00
10	20.00	25.00	22.00	21.00	20.00	26.00	36.00	23.00	18.00	21.00
11	13.00	23.00	25.00	21.00	21.00	19.00	19.00	19.00	21.00	21.00
12	8.00	25.00	25.00	26.00	24.00	24.00	24.00	25.00	20.00	8.00
13	17.00	20.00	21.00	26.00	24.00	24.00	22.00	43.00	24.00	31.00
14	31.00	21.00	25.00	18.00	23.00	24.00	19.00	22.00	26.00	27.00
15	28.00	23.00	26.00	25.00	26.00	23.00	20.00	25.00	17.00	19.00
16	24.00	23.00	26.00	25.00	24.00	22.00	20.00	21.00	23.00	23.00
17	24.00	20.00	24.00	22.00	25.00	22.00	24.00	20.00	19.00	27.00
18	24.00	19.00	24.00	23.00	18.00	26.00	24.00	31.00	17.00	27.00
19	37.00	25.00	17.00	31.00	13.00	28.00	21.00	14.00	12.00	22.00
20	17.00	31.00	26.00	28.00	24.00	25.00	36.00	20.00	24.00	24.00

**HISTOGRAMA DE LO DATOS RECOLECTADOS**





**CALCULO DEL RANGO "D"**

Se depuran un total de 10% de los datos siendo 5% por cada extremo del histograma

Lado izquierdo	
Valor a dividir (di) =	<b>9</b>
Existente (ei) =	9
Faltante (fi) =	<b>1</b>

Lado derecho	
Valor a dividir (dd) =	<b>6</b>
Existente (ed) =	5
Faltante (fd) =	<b>5</b>

N° de intervalos

Rango medio (dm) = **13**

Entonces "D" viene a ser:

$$D = \left( \frac{(d_i - f_i)}{d_i} + d_m + \frac{(d_a - f_a)}{d_a} \right) * 5 [mm]$$

D= 70.28 mm

**CÁLCULO FACTOR DE CORRECCIÓN fc:**

Donde:

- Ep = 6.2
- Li = 25
- Lf = 15

$$f_c = \left( \frac{(E_p * 10)}{(L_i - L_f) * 5} \right)$$

fc = 1.24 mm

**CÁLCULO DEL RANGO CORREGIDO Dc:**

$$D_c = D * f_c$$

Dc = 87.14 mm

**DETERMINACIÓN DEL I.R.I.:**

Para pavimentos nuevos:

I. R. I. = 0.0485 \* D<sub>c</sub>

→ (IRI<2.4)

Para pavimentos en servicio:

I. R. I. = 0.593 + 0.0471 \* D<sub>c</sub>

→ (2.4<IRI<15.9)

**CÁLCULO DEL I.R.I.:**

Aplicando la fórmula para pavimentos en servicio:

I. R. I. = 0.593 + 0.0471 \* D<sub>c</sub>

**I.R.I.= 4.70 m/km**



### RESULTADOS OBTENIDOS

Tramo urbano	IRI rugosímetro de Merlín	
	Carril de ida	
	Huella 1	Huella 2
Av. Jesús Molina (Cruce ruta San Jacinto - Casa del Mariachi)	2.93	3.06
	2.90	2.81
	1.98	2.05
Av. Felipe Palazón (Rotonda Los Leones - Calle 10)	4.29	4.41
	3.64	3.67
	4.05	3.60

Tramo urbano	IRI rugosímetro de Merlín	
	Carril de vuelta	
	Huella 1	Huella 2
Av. Jesús Molina (Cruce ruta San Jacinto - Casa del Mariachi)	2.07	2.20
	2.54	2.73
	2.95	3.26
Av. Felipe Palazón (Rotonda Los Leones - Calle 10)	3.71	4.05
	4.12	4.45
	4.62	4.70

Tramo urbano	Media rugosímetro de Merlín	
	Ida	Vuelta
Av. Jesús Molina (Cruce ruta San Jacinto - Casa del Mariachi)	2.62	2.62
Av. Felipe Palazón (Rotonda Los Leones - Calle 10)	3.94	4.27



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**LABORATORIO DE ASFALTOS**

**ANEXO D**

**DATOS Y CÁLCULO DE IRI ZONA RURAL**  
**DISPOSITIVO DE MERLÍN**



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CARRERA DE INGENIERIA CIVIL  
LABORATORIO DE ASFALTOS

**“EVALUACIÓN DE METODOLOGÍAS PARA DETERMINAR EL IRI EN PAVIMENTOS FLEXIBLES Y LA INFLUENCIA EN EL NIVEL DE SERVICIO”**

**Nombre del laboratorista/tesista:** Alejandra Ramos Quispe

**Fecha de realización del ensayo:** 24-09-2022

**Número de muestra:**3

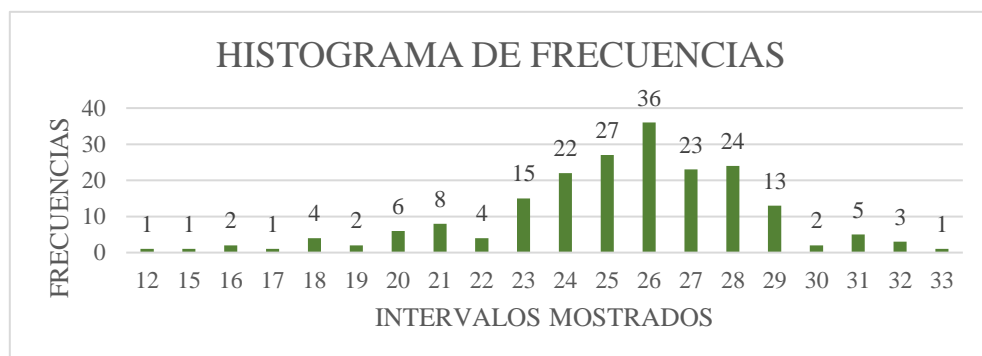
**Nombre del tramo:** El Portillo-La Pintada (Cruce Ruta 11 Villamontes - Entrada al proyecto múltiples san jacinto - oficinas)

**Carril de ida** Progresiva: 0+000 a 0+400

**Huella 1**

	1	2	3	4	5	6	7	8	9	10
1	24.00	28.00	22.00	28.00	29.00	24.00	23.00	28.00	24.00	24.00
2	28.00	27.00	25.00	28.00	25.00	24.00	26.00	18.00	26.00	29.00
3	24.00	26.00	29.00	21.00	24.00	26.00	26.00	27.00	32.00	21.00
4	26.00	24.00	25.00	24.00	29.00	26.00	28.00	24.00	25.00	28.00
5	22.00	26.00	26.00	28.00	19.00	29.00	27.00	23.00	25.00	25.00
6	32.00	27.00	25.00	26.00	18.00	27.00	25.00	24.00	28.00	28.00
7	21.00	26.00	25.00	29.00	28.00	25.00	28.00	25.00	18.00	27.00
8	23.00	20.00	23.00	28.00	29.00	27.00	28.00	23.00	24.00	29.00
9	27.00	33.00	21.00	26.00	30.00	26.00	24.00	25.00	27.00	26.00
10	26.00	23.00	24.00	26.00	31.00	27.00	23.00	27.00	26.00	23.00
11	24.00	21.00	24.00	26.00	29.00	26.00	28.00	25.00	25.00	27.00
12	21.00	23.00	26.00	29.00	23.00	27.00	27.00	20.00	21.00	23.00
13	28.00	25.00	25.00	25.00	31.00	26.00	26.00	26.00	26.00	20.00
14	28.00	25.00	25.00	23.00	19.00	28.00	27.00	18.00	27.00	24.00
15	26.00	25.00	23.00	17.00	12.00	25.00	24.00	28.00	29.00	26.00
16	27.00	26.00	26.00	28.00	29.00	27.00	26.00	28.00	26.00	27.00
17	25.00	20.00	15.00	24.00	21.00	25.00	26.00	25.00	27.00	20.00
18	26.00	31.00	26.00	25.00	31.00	26.00	29.00	27.00	31.00	25.00
19	26.00	28.00	16.00	25.00	23.00	27.00	26.00	28.00	32.00	23.00
20	22.00	24.00	30.00	24.00	22.00	24.00	27.00	28.00	16.00	20.00

**HISTOGRAMA DE LO DATOS RECOLECTADOS**





**CALCULO DEL RANGO "D"**

Se depuran un total de 10% de los datos siendo 5% por cada extremo del histograma

<b>Lado izquierdo</b>	
Valor a dividir (di) =	<b>2</b>
Existente (ei) =	<b>9</b>
Faltante (fi) =	<b>1</b>

<b>Lado derecho</b>	
Valor a dividir (dd) =	<b>2</b>
Existente (ed) =	<b>9</b>
Faltante (fd) =	<b>1</b>

N° de intervalos

Rango medio (dm) = **10**

Entonces "D" viene a ser:

$$D = \left( \frac{(d_i - f_i)}{d_i} + d_m + \frac{(d_d - f_d)}{d_d} \right) * 5 [mm]$$

D= 55 mm

**CÁLCULO FACTOR DE CORRECCIÓN fc:**

Donde:

Ep = 6.2

Li = 25

Lf = 15

$$f_c = \left( \frac{(E_p * 10)}{(L_i - L_f) * 5} \right)$$

fc = 1.24 mm

**CÁLCULO DEL RANGO CORREGIDO Dc:**

$$D_c = D * f_c$$

Dc = 68.2 mm

**DETERMINACIÓN DEL I.R.I.:**

Para pavimentos nuevos:

$$I.R.I. = 0.0485 * D_c$$

⇒ (IRI < 2.4)

Para pavimentos en servicio:

$$I.R.I. = 0.593 + 0.0471 * D_c$$

⇒ (2.4 < IRI < 15.9)

**CÁLCULO DEL I.R.I.:**

Aplicando la fórmula para pavimentos en servicio:

$$I.R.I. = 0.593 + 0.0471 * D_c$$

**I.R.I. = 3.81 m/km**



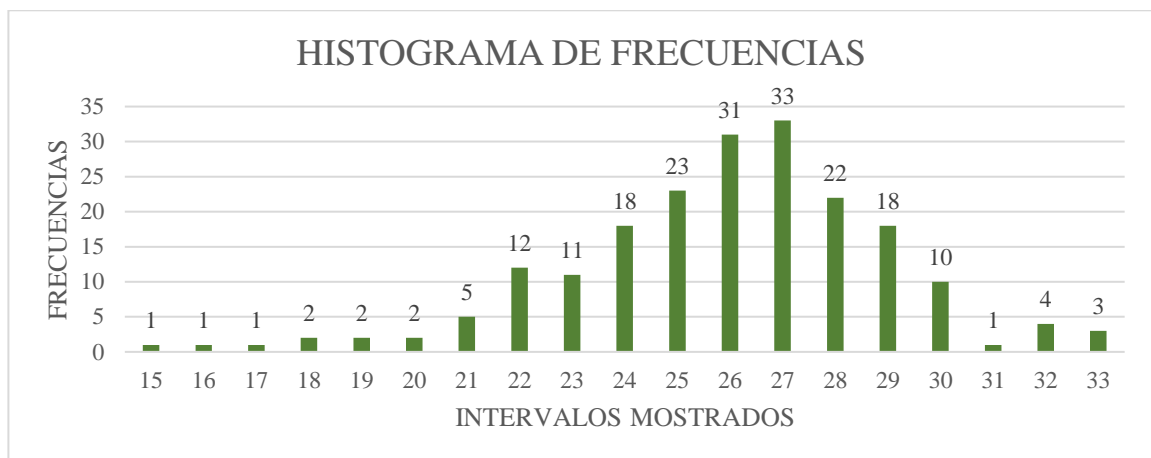
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**DPTO. DE TOPOGRAFIA Y VÍAS DE COMUNICACIÓN**  
**CARRERA DE INGENIERIA CIVIL**  
**LABORATORIO DE ASFALTOS**

**Nombre del tramo:** El Portillo-La Pintada (Cruce Ruta 11 Villamontes - Entrada al proyecto múltiples san jacinto - oficinas)

**Carril de ida** Progresiva: 0+400 a 0+800

	1	2	3	4	5	6	7	8	9	10
1	22.00	26.00	20.00	24.00	29.00	25.00	26.00	27.00	26.00	28.00
2	25.00	29.00	24.00	25.00	28.00	29.00	23.00	29.00	24.00	28.00
3	24.00	30.00	29.00	24.00	32.00	17.00	27.00	28.00	27.00	23.00
4	32.00	30.00	30.00	29.00	28.00	28.00	25.00	24.00	27.00	25.00
5	22.00	27.00	29.00	23.00	25.00	26.00	22.00	25.00	18.00	26.00
6	29.00	25.00	29.00	29.00	28.00	26.00	26.00	29.00	26.00	26.00
7	20.00	30.00	32.00	22.00	27.00	25.00	27.00	26.00	28.00	25.00
8	30.00	16.00	25.00	33.00	27.00	27.00	26.00	29.00	27.00	29.00
9	27.00	29.00	27.00	28.00	26.00	24.00	26.00	28.00	25.00	26.00
10	22.00	24.00	27.00	23.00	26.00	22.00	27.00	27.00	26.00	26.00
11	24.00	22.00	24.00	27.00	26.00	27.00	26.00	27.00	27.00	28.00
12	18.00	28.00	28.00	30.00	27.00	26.00	25.00	24.00	29.00	28.00
13	30.00	19.00	28.00	27.00	27.00	25.00	28.00	27.00	27.00	26.00
14	30.00	33.00	26.00	21.00	25.00	24.00	25.00	22.00	28.00	24.00
15	22.00	22.00	26.00	32.00	22.00	27.00	26.00	25.00	29.00	25.00
16	24.00	19.00	27.00	23.00	25.00	27.00	28.00	26.00	24.00	27.00
17	21.00	31.00	27.00	26.00	27.00	26.00	27.00	25.00	25.00	21.00
18	26.00	26.00	24.00	28.00	23.00	25.00	28.00	33.00	29.00	26.00
19	22.00	23.00	23.00	24.00	23.00	29.00	21.00	26.00	28.00	28.00
20	30.00	24.00	21.00	27.00	30.00	23.00	15.00	27.00	25.00	23.00

**HISTOGRAMA DE LO DATOS RECOLECTADOS**





**CALCULO DEL RANGO "D"**

Se depuran un total de 10% de los datos siendo 5% por cada extremo del histograma

Lado izquierdo	
Valor a dividir (di) =	<b>5</b>
Existente (ei) =	9
Faltante (fi) =	<b>1</b>

Lado derecho	
Valor a dividir (dd) =	<b>10</b>
Existente (ed) =	8
Faltante (fd) =	<b>2</b>

N° de intervalos

Rango medio (dm) = **8**

Entonces "D" viene a ser:

$$D = \left( \frac{(d_i - f_i)}{d_i} + d_m + \frac{(d_d - f_d)}{d_d} \right) * 5 [mm]$$

D= 48 mm

**CÁLCULO FACTOR DE CORRECCIÓN fc:**

Donde:

Ep = 6.2  
 Li = 25  
 Lf = 15

$$f_c = \left( \frac{(E_p * 10)}{(L_i - L_f) * 5} \right)$$

fc = 1.24 mm

**CÁLCULO DEL RANGO CORREGIDO Dc:**

$$D_c = D * f_c$$

Dc = 59.52 mm

**DETERMINACIÓN DEL I.R.I.:**

Para pavimentos nuevos:

$$I.R.I. = 0.0485 * D_c$$

→ (IRI < 2.4)

Para pavimentos en servicio:

$$I.R.I. = 0.593 + 0.0471 * D_c$$

→ (2.4 < IRI < 15.9)

**CÁLCULO DEL I.R.I.:**

Aplicando la fórmula para pavimentos en servicio:

$$I.R.I. = 0.593 + 0.0471 * D_c$$

I.R.I. = 3.40 m/km





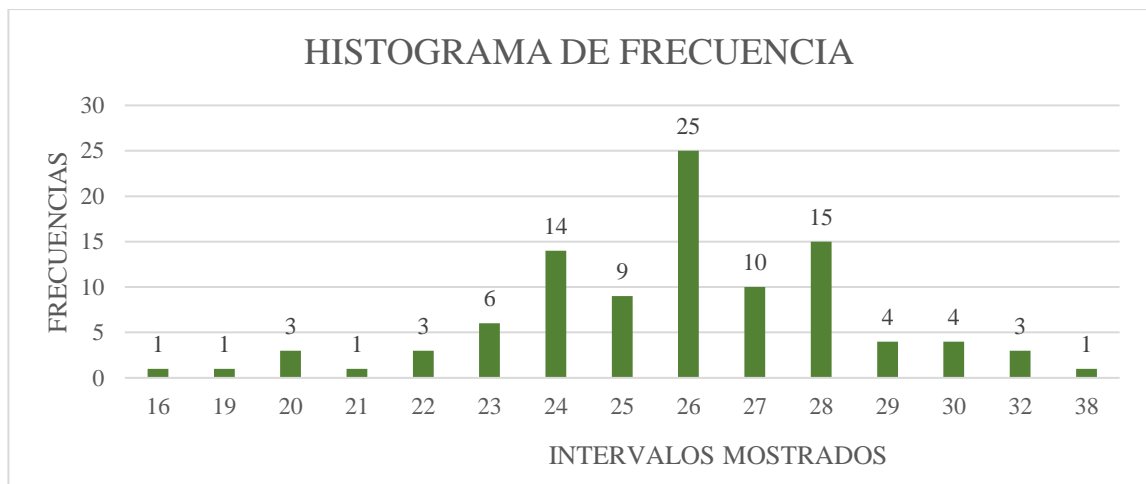
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**CARRERA DE INGENIERIA CIVIL**  
**LABORATORIO DE ASFALTOS**

**Nombre del tramo:** El Portillo-La Pintada (Cruce Ruta 11 Villamontes - Entrada al proyecto múltiples san jacinto - oficinas)

**Carril de ida** Progresiva: 0+800 a 1+000

	1	2	3	4	5	6	7	8	9	10
1	26.00	28.00	26.00	26.00	26.00	25.00	20.00	23.00	25.00	27.00
2	23.00	23.00	26.00	27.00	26.00	23.00	27.00	20.00	25.00	26.00
3	30.00	27.00	26.00	28.00	27.00	28.00	27.00	24.00	26.00	28.00
4	28.00	23.00	26.00	21.00	25.00	27.00	27.00	30.00	23.00	20.00
5	28.00	29.00	26.00	27.00	26.00	22.00	30.00	27.00	27.00	23.00
6	25.00	26.00	28.00	29.00	24.00	27.00	25.00	25.00	23.00	24.00
7	25.00	28.00	28.00	25.00	25.00	30.00	16.00	28.00	24.00	21.00
8	25.00	24.00	25.00	26.00	20.00	24.00	28.00	20.00	25.00	25.00
9	26.00	22.00	24.00	26.00	16.00	20.00	24.00	38.00	25.00	25.00
10	32.00	28.00	28.00	26.00	27.00	22.00	24.00	18.00	30.00	22.00
11	23.00	22.00	24.00	26.00	20.00	25.00	27.00	12.00	26.00	22.00
12	20.00	26.00	32.00	26.00	30.00	24.00	26.00	28.00	24.00	26.00
13	24.00	30.00	26.00	22.00	29.00	26.00	26.00	26.00	24.00	27.00
14	28.00	30.00	23.00	25.00	26.00	25.00	27.00	24.00	25.00	26.00
15	24.00	24.00	27.00	29.00	28.00	23.00	26.00	25.00	25.00	28.00
16	38.00	26.00	28.00	24.00	32.00	23.00	28.00	27.00	25.00	25.00
17	24.00	26.00	27.00	25.00	24.00	26.00	28.00	29.00	27.00	25.00
18	19.00	27.00	27.00	27.00	28.00	19.00	24.00	26.00	21.00	25.00
19	24.00	26.00	28.00	26.00	24.00	24.00	25.00	26.00	22.00	24.00
20	24.00	26.00	23.00	28.00	24.00	24.00	28.00	23.00	24.00	28.00

**HISTOGRAMA DE LO DATOS RECOLECTADOS**





**CALCULO DEL RANGO "D"**

Se depuran un total de 10% de los datos siendo 5% por cada extremo del histograma

Lado izquierdo	
Valor a dividir (di) =	<b>6</b>
Existente (ei) =	9
Faltante (fi) =	<b>1</b>

Lado derecho	
Valor a dividir (dd) =	<b>4</b>
Existente (ed) =	8
Faltante (fd) =	<b>2</b>

N° de intervalos

Rango medio (dm) = **5**

Entonces "D" viene a ser:

$$D = \left( \frac{(d_i - f_i)}{d_i} + d_m + \frac{(d_d - f_d)}{d_d} \right) * 5 [mm]$$

D= 31.67 mm

**CÁLCULO FACTOR DE CORRECCIÓN fc:**

Donde:

Ep = 6.2

Li = 25

Lf = 15

$$f_c = \left( \frac{(E_p * 10)}{(L_i - L_f) * 5} \right)$$

fc = 1.24 mm

**CÁLCULO DEL RANGO CORREGIDO Dc:**

$D_c = D * f_c$

Dc = 39.27 mm

**DETERMINACIÓN DEL I.R.I.:**

Para pavimentos nuevos:

I.R.I. = 0.0485 \* D<sub>c</sub>

→ (IRI < 2.4)

Para pavimentos en servicio:

I.R.I. = 0.593 + 0.0471 \* D<sub>c</sub>

→ (2.4 < IRI < 15.9)

**CÁLCULO DEL I.R.I.:**

Aplicando la fórmula para pavimentos en servicio:

I.R.I. = 0.593 + 0.0471 \* D<sub>c</sub>

I.R.I. = 2.44 m/km



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 LABORATORIO DE ASFALTOS

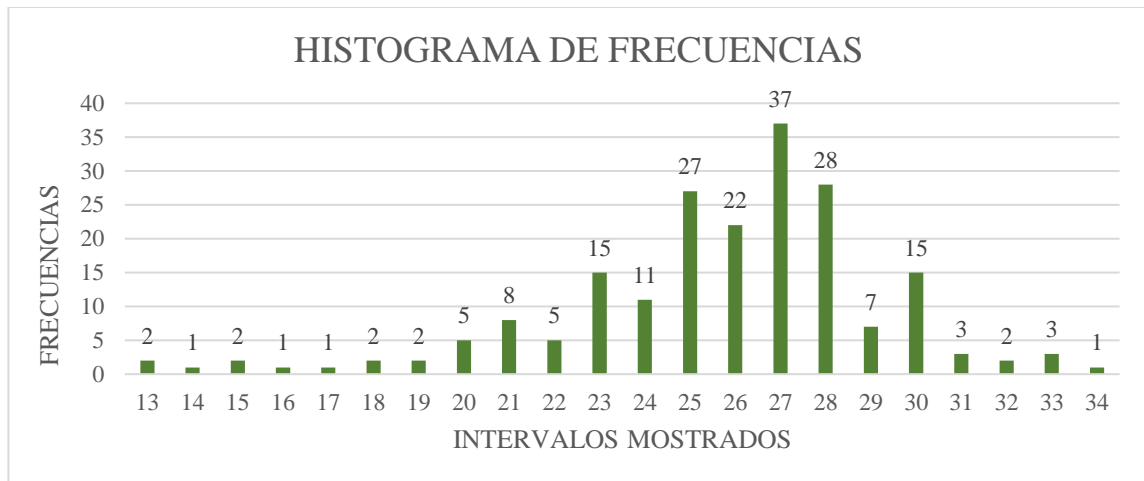
**Nombre del tramo:** El Portillo-La Pintada (Cruce Ruta 11 Villamontes - Entrada al proyecto múltiples san jacinto - oficinas)

**Carril de ida** Progresiva: 0+000 a 0+400

**Huella 2**

	1	2	3	4	5	6	7	8	9	10
1	25.00	28.00	23.00	29.00	30.00	25.00	23.00	29.00	25.00	25.00
2	30.00	28.00	26.00	28.00	26.00	25.00	27.00	8.00	27.00	30.00
3	25.00	26.00	30.00	20.00	25.00	26.00	28.00	28.00	33.00	21.00
4	27.00	24.00	27.00	24.00	30.00	28.00	28.00	24.00	26.00	28.00
5	23.00	25.00	27.00	28.00	19.00	30.00	27.00	24.00	26.00	25.00
6	33.00	27.00	27.00	28.00	18.00	27.00	26.00	25.00	30.00	29.00
7	22.00	27.00	26.00	30.00	27.00	28.00	28.00	25.00	19.00	27.00
8	23.00	20.00	23.00	28.00	30.00	27.00	28.00	22.00	25.00	30.00
9	25.00	34.00	21.00	27.00	30.00	25.00	25.00	25.00	27.00	27.00
10	26.00	23.00	23.00	27.00	31.00	27.00	24.00	25.00	27.00	23.00
11	26.00	20.00	22.00	27.00	30.00	27.00	28.00	25.00	25.00	28.00
12	20.00	23.00	26.00	30.00	25.00	27.00	29.00	21.00	22.00	23.00
13	28.00	24.00	24.00	26.00	31.00	26.00	26.00	27.00	27.00	22.00
14	28.00	25.00	24.00	23.00	20.00	29.00	27.00	17.00	27.00	24.00
15	27.00	26.00	23.00	16.00	13.00	26.00	23.00	18.00	30.00	28.00
16	27.00	26.00	27.00	28.00	30.00	27.00	26.00	28.00	27.00	28.00
17	26.00	21.00	14.00	25.00	21.00	25.00	28.00	27.00	28.00	21.00
18	24.00	32.00	27.00	25.00	32.00	27.00	28.00	27.00	28.00	25.00
19	26.00	28.00	15.00	26.00	23.00	27.00	26.00	28.00	33.00	24.00
20	23.00	27.00	31.00	25.00	21.00	25.00	29.00	29.00	15.00	21.00

**HISTOGRAMA DE LO DATOS RECOLECTADOS**





**CALCULO DEL RANGO "D"**

Se depuran un total de 10% de los datos siendo 5% por cada extremo del histograma

<b>Lado izquierdo</b>	
Valor a dividir (di) =	<b>2</b>
Existente (ei) =	9
Faltante (fi) =	<b>1</b>

<b>Lado derecho</b>	
Valor a dividir (dd) =	<b>15</b>
Existente (ed) =	9
Faltante (fd) =	<b>1</b>

Nº de intervalos

Rango medio (dm) = **10**

Entonces "D" viene a ser:

$$D = \left( \frac{(d_i - f_i)}{d_i} + d_m + \frac{(d_a - f_a)}{d_a} \right) * 5 [mm]$$

$$D = 57.17 \text{ mm}$$

**CÁLCULO FACTOR DE CORRECCIÓN fc:**

Donde:

$$E_p = 6.2$$

$$L_i = 25$$

$$L_f = 15$$

$$f_c = \left( \frac{(E_p * 10)}{(L_i - L_f) * 5} \right)$$

$$f_c = 1.24 \text{ mm}$$

**CÁLCULO DEL RANGO CORREGIDO Dc:**

$$D_c = D * f_c$$

$$D_c = 70.89 \text{ mm}$$

**DETERMINACIÓN DEL I.R.I.:**

Para pavimentos nuevos:

$$I. R. I. = 0.0485 * D_c$$

→ (IRI < 2.4)

Para pavimentos en servicio:

$$I. R. I. = 0.593 + 0.0471 * D_c$$

→ (2.4 < IRI < 15.9)

**CÁLCULO DEL I.R.I.:**

Aplicando la fórmula para pavimentos en servicio:

$$I. R. I. = 0.593 + 0.0471 * D_c$$

$$I. R. I. = 3.93 \text{ m/km}$$



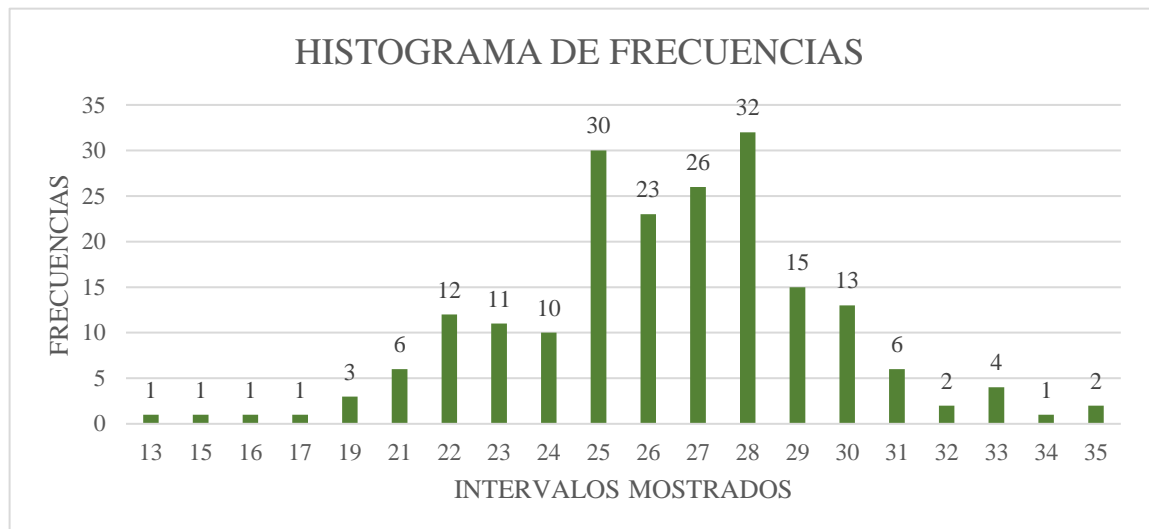
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**LABORATORIO DE ASFALTOS**

**Nombre del tramo:** El Portillo-La Pintada (Cruce Ruta 11 Villamontes - Entrada al proyecto múltiples san jacinto - oficinas)

**Carril de ida** Progresiva: 0+400 a 0+800

	1	2	3	4	5	6	7	8	9	10
1	23.00	28.00	21.00	23.00	28.00	27.00	28.00	30.00	27.00	25.00
2	26.00	29.00	26.00	25.00	29.00	29.00	25.00	29.00	24.00	22.00
3	25.00	31.00	30.00	26.00	33.00	15.00	28.00	28.00	28.00	23.00
4	33.00	30.00	30.00	29.00	29.00	29.00	25.00	23.00	28.00	25.00
5	24.00	28.00	28.00	23.00	27.00	26.00	25.00	25.00	17.00	26.00
6	30.00	25.00	27.00	30.00	30.00	26.00	26.00	30.00	26.00	25.00
7	22.00	31.00	33.00	22.00	27.00	25.00	22.00	28.00	28.00	25.00
8	31.00	16.00	27.00	34.00	27.00	29.00	26.00	29.00	28.00	28.00
9	28.00	30.00	27.00	30.00	28.00	24.00	27.00	29.00	25.00	26.00
10	24.00	23.00	28.00	25.00	28.00	21.00	27.00	27.00	26.00	26.00
11	24.00	22.00	26.00	27.00	27.00	27.00	24.00	27.00	26.00	29.00
12	19.00	29.00	28.00	28.00	25.00	27.00	25.00	24.00	30.00	28.00
13	31.00	19.00	28.00	28.00	25.00	25.00	28.00	28.00	27.00	25.00
14	31.00	35.00	29.00	22.00	25.00	22.00	26.00	23.00	28.00	24.00
15	22.00	23.00	27.00	33.00	22.00	27.00	26.00	26.00	30.00	25.00
16	25.00	19.00	28.00	25.00	27.00	27.00	28.00	27.00	24.00	26.00
17	21.00	32.00	28.00	28.00	27.00	26.00	27.00	27.00	25.00	22.00
18	25.00	26.00	25.00	29.00	23.00	25.00	26.00	35.00	28.00	26.00
19	22.00	25.00	21.00	27.00	23.00	30.00	21.00	24.00	28.00	25.00
20	31.00	25.00	21.00	29.00	32.00	26.00	13.00	28.00	23.00	22.00

**HISTOGRAMA DE LO DATOS RECOLECTADOS**





**CALCULO DEL RANGO "D"**

Se depuran un total de 10% de los datos siendo 5% por cada extremo del histograma

Lado izquierdo	
Valor a dividir (di) =	<b>6</b>
Existente (ei) =	7
Faltante (fi) =	<b>3</b>

Lado derecho	
Valor a dividir (dd) =	<b>6</b>
Existente (ed) =	9
Faltante (fd) =	<b>1</b>

N° de intervalos

Rango medio (dm) = **9**

Entonces "D" viene a ser:

$$D = \left( \frac{(d_i - f_i)}{d_i} + d_m + \frac{(d_d - f_d)}{d_d} \right) * 5 [mm]$$

D= 51.67 mm

**CÁLCULO FACTOR DE CORRECCIÓN fc:**

Donde:

Ep = 6.2  
 Li = 25  
 Lf = 15

$$f_c = \left( \frac{(E_p * 10)}{(L_i - L_f) * 5} \right)$$

fc = 1.24 mm

**CÁLCULO DEL RANGO CORREGIDO Dc:**

$$D_c = D * f_c$$

Dc = 64.07 mm

**DETERMINACIÓN DEL I.R.I.:**

Para pavimentos nuevos:

$$I.R.I. = 0.0485 * D_c$$

→ (IRI<2.4)

Para pavimentos en servicio:

$$I.R.I. = 0.593 + 0.0471 * D_c$$

→ (2.4<IRI<15.9)

**CÁLCULO DEL I.R.I.:**

Aplicando la fórmula para pavimentos en servicio:

$$I.R.I. = 0.593 + 0.0471 * D_c$$

**I.R.I.= 3.61 m/km**



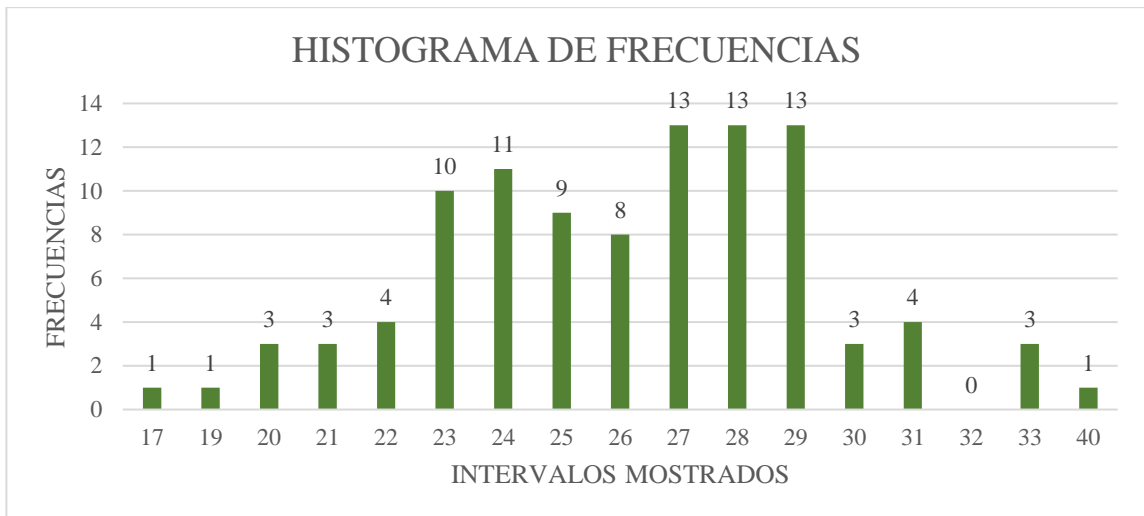
**UNIVERSIDAD AUTÓNOMA JUAN MISAEL SARACHO**  
**FACULTAD CIENCIAS Y TECNOLOGÍA**  
**DPTO. DE TOPOGRAFIA Y VÍAS DE COMUNICACIÓN**  
**CARRERA DE INGENIERIA CIVIL**  
**LABORATORIO DE ASFALTOS**

**Nombre del tramo:** El Portillo-La Pintada (Cruce Ruta 11 Villamontes - Entrada al proyecto múltiples san jacinto - oficinas)

**Carril de ida** Progresiva: 0+800 a 1+000

	1	2	3	4	5	6	7	8	9	10
1	28.00	29.00	25.00	23.00	23.00	24.00	19.00	22.00	27.00	28.00
2	22.00	22.00	24.00	29.00	27.00	23.00	26.00	20.00	23.00	28.00
3	31.00	27.00	27.00	28.00	27.00	27.00	26.00	22.00	28.00	29.00
4	29.00	22.00	26.00	23.00	24.00	27.00	26.00	31.00	20.00	21.00
5	29.00	30.00	26.00	27.00	29.00	22.00	31.00	29.00	27.00	23.00
6	25.00	26.00	29.00	30.00	25.00	28.00	26.00	26.00	22.00	23.00
7	23.00	29.00	29.00	24.00	25.00	31.00	15.00	29.00	24.00	20.00
8	23.00	24.00	24.00	26.00	19.00	24.00	27.00	21.00	27.00	25.00
9	26.00	21.00	24.00	26.00	17.00	21.00	23.00	40.00	25.00	25.00
10	33.00	29.00	29.00	22.00	28.00	22.00	24.00	18.00	31.00	20.00
11	23.00	20.00	24.00	26.00	21.00	25.00	27.00	10.00	27.00	21.00
12	21.00	27.00	33.00	26.00	31.00	23.00	27.00	28.00	24.00	27.00
13	24.00	31.00	28.00	20.00	28.00	26.00	26.00	24.00	24.00	27.00
14	27.00	31.00	25.00	27.00	28.00	26.00	28.00	24.00	26.00	28.00
15	24.00	24.00	28.00	29.00	28.00	23.00	26.00	27.00	26.00	29.00
16	40.00	25.00	28.00	23.00	33.00	24.00	29.00	27.00	26.00	15.00
17	27.00	25.00	27.00	27.00	25.00	26.00	29.00	29.00	27.00	19.00
18	20.00	27.00	28.00	29.00	28.00	20.00	25.00	27.00	22.00	25.00
19	24.00	28.00	29.00	28.00	25.00	24.00	25.00	26.00	24.00	25.00
20	23.00	27.00	23.00	30.00	23.00	21.00	27.00	22.00	24.00	29.00

**HISTOGRAMA DE LO DATOS RECOLECTADOS**





**CALCULO DEL RANGO "D"**

Se depuran un total de 10% de los datos siendo 5% por cada extremo del histograma

<b>Lado izquierdo</b>	
Valor a dividir (di) =	<b>4</b>
Existente (ei) =	<b>8</b>
Faltante (fi) =	<b>2</b>

<b>Lado derecho</b>	
Valor a dividir (dd) =	<b>3</b>
Existente (ed) =	<b>8</b>
Faltante (fd) =	<b>2</b>

N° de intervalos

Rango medio (dm) = **7**

Entonces "D" viene a ser:

$$D = \left( \frac{(d_i - f_i)}{d_i} + d_m + \frac{(d_a - f_a)}{d_a} \right) * 5 [mm]$$

D= 39.17 mm

**CÁLCULO FACTOR DE CORRECCIÓN fc:**

Donde:

Ep = 6.2  
 Li = 25  
 Lf = 15

$$f_c = \left( \frac{(E_p * 10)}{(L_i - L_f) * 5} \right)$$

fc = 1.24 mm

**CÁLCULO DEL RANGO CORREGIDO Dc:**

$$D_c = D * f_c$$

Dc = 48.57 mm

**DETERMINACIÓN DEL I.R.I.:**

Para pavimentos nuevos:

$$I.R.I. = 0.0485 * D_c$$

→ (IRI < 2.4)

Para pavimentos en servicio:

$$I.R.I. = 0.593 + 0.0471 * D_c$$

→ (2.4 < IRI < 15.9)

**CÁLCULO DEL I.R.I.:**

Aplicando la fórmula para pavimentos en servicio:

$$I.R.I. = 0.593 + 0.0471 * D_c$$

I.R.I. = 2.88 m/km





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**LABORATORIO DE ASFALTOS**

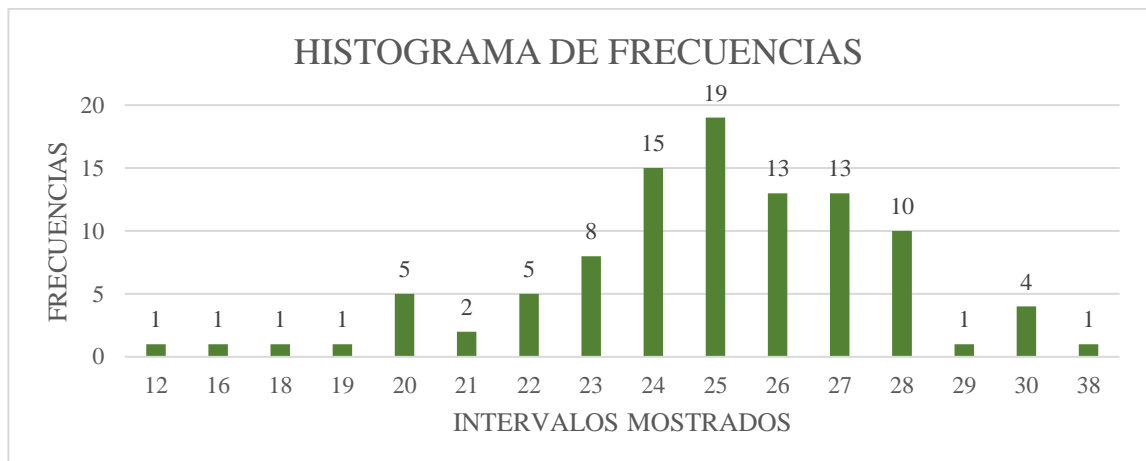
**Nombre del tramo:** El Portillo-La Pintada (Cruce Ruta 11 Villamontes - Entrada al proyecto múltiples san jacinto - oficinas)

**Carril de vuelta** Progresiva: 1+000 a 0+800

**Huella 1**

	1	2	3	4	5	6	7	8	9	10
1	26.00	28.00	26.00	26.00	26.00	25.00	20.00	23.00	25.00	27.00
2	23.00	23.00	26.00	27.00	26.00	23.00	27.00	20.00	25.00	26.00
3	30.00	27.00	26.00	28.00	27.00	28.00	27.00	24.00	26.00	28.00
4	28.00	23.00	26.00	21.00	25.00	27.00	27.00	30.00	23.00	20.00
5	28.00	29.00	26.00	27.00	26.00	22.00	30.00	27.00	27.00	23.00
6	25.00	26.00	28.00	29.00	24.00	27.00	25.00	25.00	23.00	24.00
7	25.00	28.00	28.00	25.00	25.00	30.00	16.00	28.00	24.00	21.00
8	25.00	24.00	25.00	26.00	20.00	24.00	28.00	20.00	25.00	25.00
9	26.00	22.00	24.00	26.00	16.00	20.00	24.00	38.00	25.00	25.00
10	32.00	28.00	28.00	26.00	27.00	22.00	24.00	18.00	30.00	22.00
11	23.00	22.00	24.00	26.00	20.00	25.00	27.00	12.00	26.00	22.00
12	20.00	26.00	32.00	26.00	30.00	24.00	26.00	28.00	24.00	26.00
13	24.00	30.00	26.00	22.00	29.00	26.00	26.00	26.00	24.00	27.00
14	28.00	30.00	23.00	25.00	26.00	25.00	27.00	24.00	25.00	26.00
15	24.00	24.00	27.00	29.00	28.00	23.00	26.00	25.00	25.00	28.00
16	38.00	26.00	28.00	24.00	32.00	23.00	28.00	27.00	25.00	25.00
17	24.00	26.00	27.00	25.00	24.00	26.00	28.00	29.00	27.00	25.00
18	19.00	27.00	27.00	27.00	28.00	19.00	24.00	26.00	21.00	25.00
19	24.00	26.00	28.00	26.00	24.00	24.00	25.00	26.00	22.00	24.00
20	24.00	26.00	23.00	28.00	24.00	24.00	28.00	23.00	24.00	28.00

**HISTOGRAMA DE LO DATOS RECOLECTADOS**





**CALCULO DEL RANGO "D"**

Se depuran un total de 10% de los datos siendo 5% por cada extremo del histograma

Lado izquierdo	
Valor a dividir (di) =	2
Existente (ei) =	9
Faltante (fi) =	1

Lado derecho	
Valor a dividir (dd) =	10
Existente (ed) =	6
Faltante (fd) =	4

N° de intervalos

Rango medio (dm) = 7

Entonces "D" viene a ser:

$$D = \left( \frac{(d_i - f_i)}{d_i} + d_m + \frac{(d_d - f_d)}{d_d} \right) * 5 \text{ [mm]}$$

D= 40.5 mm

**CÁLCULO FACTOR DE CORRECCIÓN fc:**

Donde:

Ep = 6.2  
 Li = 25  
 Lf = 15

$$f_c = \left( \frac{(E_p * 10)}{(L_i - L_f) * 5} \right)$$

fc = 1.24 mm

**CÁLCULO DEL RANGO CORREGIDO Dc:**

$$D_c = D * f_c$$

Dc = 50.22 mm

**DETERMINACIÓN DEL I.R.I.:**

Para pavimentos nuevos:

$$I.R.I. = 0.0485 * D_c$$

(IRI < 2.4)

Para pavimentos en servicio:

$$I.R.I. = 0.593 + 0.0471 * D_c$$

(2.4 < IRI < 15.9)

**CÁLCULO DEL I.R.I.:**

Aplicando la fórmula para pavimentos en servicio:

$$I.R.I. = 0.593 + 0.0471 * D_c$$

I.R.I. = 2.96 m/km



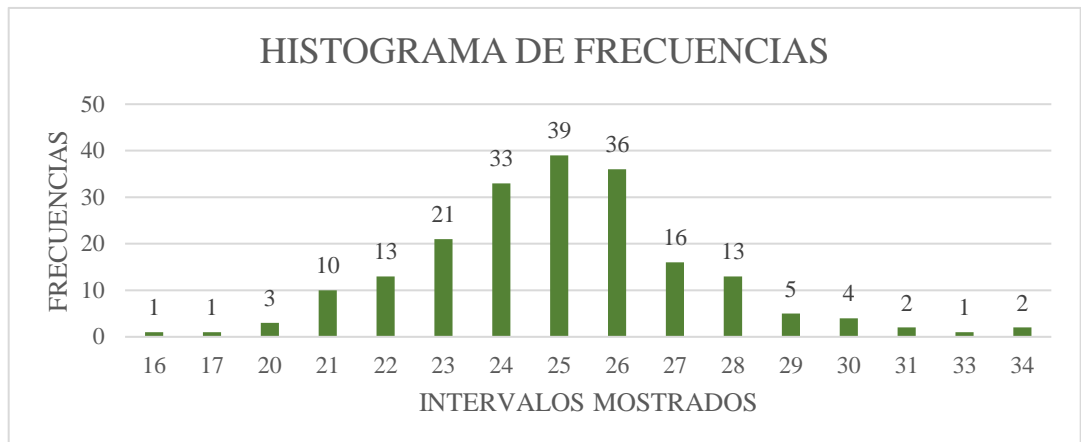
**UNIVERSIDAD AUTÓNOMA JUAN MISAEL SARACHO**  
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**LABORATORIO DE ASFALTOS**

**Nombre del tramo:** El Portillo-La Pintada (Cruce Ruta 11 Villamontes - Entrada al proyecto múltiples san jacinto - oficinas)

**Carril de vuelta** Progresiva: 0+800 a 0+400

	1	2	3	4	5	6	7	8	9	10
1	29.00	27.00	24.00	27.00	22.00	27.00	25.00	26.00	27.00	25.00
2	25.00	31.00	26.00	22.00	21.00	25.00	24.00	22.00	25.00	23.00
3	22.00	25.00	23.00	25.00	25.00	22.00	26.00	24.00	27.00	26.00
4	25.00	23.00	26.00	27.00	24.00	24.00	26.00	25.00	25.00	23.00
5	26.00	26.00	27.00	21.00	26.00	25.00	25.00	29.00	26.00	25.00
6	21.00	26.00	23.00	25.00	26.00	16.00	27.00	28.00	22.00	26.00
7	22.00	22.00	22.00	24.00	25.00	28.00	26.00	24.00	24.00	28.00
8	26.00	25.00	26.00	22.00	23.00	26.00	25.00	27.00	21.00	24.00
9	26.00	28.00	24.00	23.00	27.00	25.00	26.00	24.00	24.00	28.00
10	21.00	23.00	30.00	25.00	26.00	28.00	24.00	26.00	23.00	24.00
11	26.00	25.00	26.00	25.00	25.00	26.00	17.00	26.00	24.00	21.00
12	28.00	24.00	25.00	27.00	23.00	26.00	25.00	23.00	24.00	28.00
13	24.00	25.00	24.00	24.00	23.00	21.00	31.00	23.00	30.00	24.00
14	24.00	28.00	30.00	28.00	21.00	25.00	23.00	26.00	25.00	27.00
15	24.00	25.00	29.00	24.00	24.00	26.00	25.00	24.00	25.00	27.00
16	25.00	20.00	30.00	25.00	24.00	24.00	26.00	28.00	23.00	34.00
17	22.00	23.00	24.00	23.00	25.00	26.00	25.00	23.00	26.00	34.00
18	22.00	24.00	25.00	28.00	25.00	23.00	21.00	23.00	27.00	27.00
19	24.00	27.00	29.00	26.00	28.00	24.00	23.00	24.00	25.00	26.00
20	20.00	26.00	21.00	25.00	29.00	26.00	20.00	26.00	22.00	33.00

**HISTOGRAMA DE LO DATOS RECOLECTADOS**





**CALCULO DEL RANGO "D"**

Se depuran un total de 10% de los datos siendo 5% por cada extremo del histograma

Lado izquierdo	
Valor a dividir (di) =	<b>10</b>
Existente (ei) =	<b>5</b>
Faltante (fi) =	<b>5</b>

Lado derecho	
Valor a dividir (dd) =	<b>5</b>
Existente (ed) =	<b>9</b>
Faltante (fd) =	<b>1</b>

N° de intervalos

Rango medio (dm) = **7**

Entonces "D" viene a ser:

$$D = \left( \frac{(d_i - f_i)}{d_i} + d_m + \frac{(d_d - f_d)}{d_d} \right) * 5 [mm]$$

D= 41.5 mm

**CÁLCULO FACTOR DE CORRECCIÓN fc:**

Donde:

Ep = 6.2

Li = 25

Lf = 15

$$f_c = \left( \frac{(E_p * 10)}{(L_i - L_f) * 5} \right)$$

fc = 1.24 mm

**CÁLCULO DEL RANGO CORREGIDO Dc:**

$$D_c = D * f_c$$

Dc = 51.46 mm

**DETERMINACIÓN DEL I.R.I.:**

Para pavimentos nuevos:

$$I. R. I. = 0.0485 * D_c$$

→ (IRI < 2.4)

Para pavimentos en servicio:

$$I. R. I. = 0.593 + 0.0471 * D_c$$

→ (2.4 < IRI < 15.9)

**CÁLCULO DEL I.R.I.:**

Aplicando la fórmula para pavimentos en servicio:

$$I. R. I. = 0.593 + 0.0471 * D_c$$

**I.R.I.= 3.02 m/km**



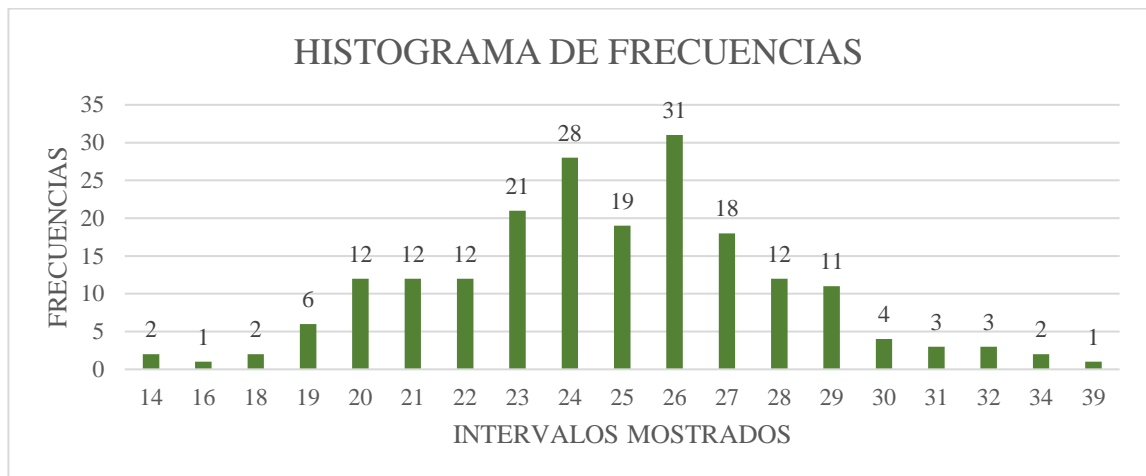
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**LABORATORIO DE ASFALTOS**

**Nombre del tramo:** El Portillo-La Pintada (Cruce Ruta 11 Villamontes - Entrada al proyecto múltiples san jacinto - oficinas)

**Carril de vuelta** Progresiva: 0+400 a 0+000

	1	2	3	4	5	6	7	8	9	10
1	22.00	23.00	25.00	24.00	26.00	19.00	27.00	27.00	26.00	19.00
2	26.00	26.00	24.00	26.00	22.00	32.00	28.00	30.00	23.00	24.00
3	20.00	27.00	23.00	39.00	24.00	29.00	20.00	26.00	26.00	27.00
4	26.00	26.00	25.00	34.00	24.00	22.00	20.00	31.00	26.00	26.00
5	25.00	27.00	27.00	28.00	27.00	29.00	28.00	29.00	24.00	23.00
6	26.00	21.00	26.00	28.00	26.00	18.00	29.00	28.00	24.00	21.00
7	25.00	26.00	25.00	23.00	29.00	20.00	23.00	23.00	23.00	19.00
8	24.00	23.00	25.00	24.00	25.00	27.00	20.00	26.00	18.00	26.00
9	24.00	24.00	24.00	25.00	28.00	28.00	29.00	29.00	25.00	24.00
10	29.00	20.00	24.00	23.00	16.00	24.00	26.00	28.00	20.00	26.00
11	23.00	29.00	26.00	28.00	22.00	27.00	26.00	20.00	28.00	25.00
12	24.00	21.00	25.00	24.00	22.00	22.00	25.00	26.00	22.00	25.00
13	27.00	26.00	25.00	27.00	21.00	26.00	23.00	27.00	23.00	22.00
14	23.00	23.00	21.00	29.00	24.00	32.00	23.00	23.00	24.00	20.00
15	26.00	24.00	32.00	19.00	24.00	23.00	22.00	21.00	20.00	25.00
16	26.00	31.00	23.00	27.00	25.00	24.00	34.00	21.00	19.00	19.00
17	24.00	14.00	23.00	21.00	25.00	27.00	14.00	22.00	30.00	20.00
18	23.00	30.00	24.00	29.00	27.00	26.00	26.00	30.00	22.00	21.00
19	27.00	27.00	28.00	24.00	21.00	24.00	31.00	27.00	24.00	25.00
20	28.00	26.00	20.00	21.00	24.00	26.00	22.00	25.00	21.00	26.00

**HISTOGRAMA DE LO DATOS RECOLECTADOS**





**CALCULO DEL RANGO "D"**

Se depuran un total de 10% de los datos siendo 5% por cada extremo del histograma

Lado izquierdo	
Valor a dividir (di) =	<b>6</b>
Existente (ei) =	<b>5</b>
Faltante (fi) =	<b>5</b>

Lado derecho	
Valor a dividir (dd) =	<b>4</b>
Existente (ed) =	<b>9</b>
Faltante (fd) =	<b>1</b>

N° de intervalos

Rango medio (dm) = **10**

Entonces "D" viene a ser:

$$D = \left( \frac{(d_i - f_i)}{d_i} + d_m + \frac{(d_d - f_d)}{d_d} \right) * 5 [mm]$$

D= 54.58 mm

**CÁLCULO FACTOR DE CORRECCIÓN fc:**

Donde:

Ep = 6.2  
 Li = 25  
 Lf = 15

$$f_c = \left( \frac{(E_p * 10)}{(L_i - L_f) * 5} \right)$$

fc = 1.24 mm

**CÁLCULO DEL RANGO CORREGIDO Dc:**

$$D_c = D * f_c$$

Dc = 67.68 mm

**DETERMINACIÓN DEL I.R.I.:**

Para pavimentos nuevos:

$$I.R.I. = 0.0485 * D_c$$

→ (IRI<2.4)

Para pavimentos en servicio:

$$I.R.I. = 0.593 + 0.0471 * D_c$$

→ (2.4<IRI<15.9)

**CÁLCULO DEL I.R.I.:**

Aplicando la fórmula para pavimentos en servicio:

$$I.R.I. = 0.593 + 0.0471 * D_c$$

**I.R.I.= 3.78 m/km**



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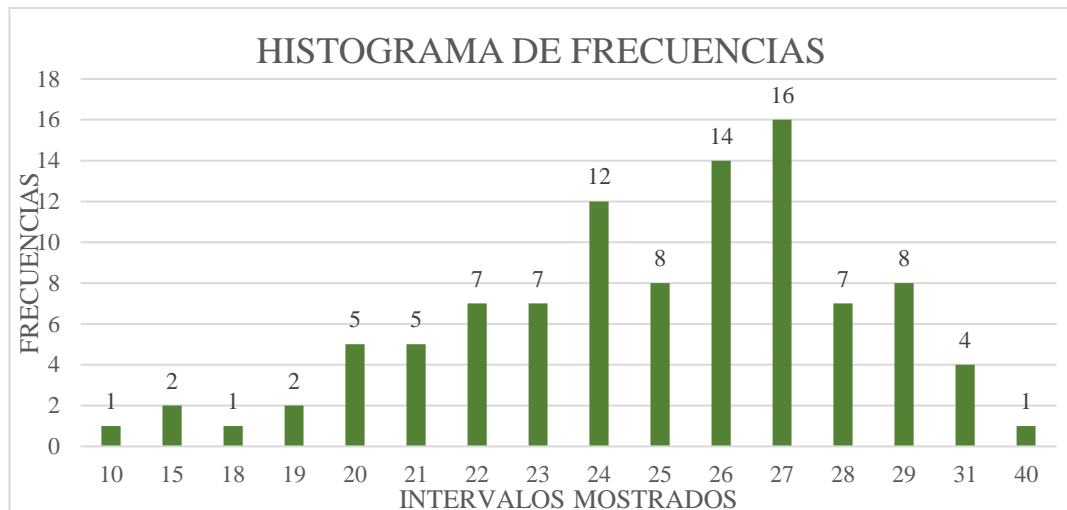
**Nombre del tramo:** El Portillo-La Pintada (Cruce Ruta 11 Villamontes - Entrada al proyecto múltiples san jacinto - oficinas)

**Carril de vuelta** Progresiva: 1+000 a 0+800

**Huella 2**

	1	2	3	4	5	6	7	8	9	10
1	28.00	29.00	25.00	23.00	23.00	24.00	19.00	22.00	27.00	28.00
2	22.00	22.00	24.00	29.00	27.00	23.00	26.00	20.00	23.00	28.00
3	31.00	27.00	27.00	28.00	27.00	27.00	26.00	22.00	28.00	29.00
4	29.00	22.00	26.00	23.00	24.00	27.00	26.00	31.00	20.00	21.00
5	29.00	30.00	26.00	27.00	29.00	22.00	31.00	29.00	27.00	23.00
6	25.00	26.00	29.00	30.00	25.00	28.00	26.00	26.00	22.00	23.00
7	23.00	29.00	29.00	24.00	25.00	31.00	15.00	29.00	24.00	20.00
8	23.00	24.00	24.00	26.00	19.00	24.00	27.00	21.00	27.00	25.00
9	26.00	21.00	24.00	26.00	17.00	21.00	23.00	40.00	25.00	25.00
10	33.00	29.00	29.00	22.00	28.00	22.00	24.00	18.00	31.00	20.00
11	23.00	20.00	24.00	26.00	21.00	25.00	27.00	10.00	27.00	21.00
12	21.00	27.00	33.00	26.00	31.00	23.00	27.00	28.00	24.00	27.00
13	24.00	31.00	28.00	20.00	28.00	26.00	26.00	24.00	24.00	27.00
14	27.00	31.00	25.00	27.00	28.00	26.00	28.00	24.00	26.00	28.00
15	24.00	24.00	28.00	29.00	28.00	23.00	26.00	27.00	26.00	29.00
16	40.00	25.00	28.00	23.00	33.00	24.00	29.00	27.00	26.00	15.00
17	27.00	25.00	27.00	27.00	25.00	26.00	29.00	29.00	27.00	19.00
18	20.00	27.00	28.00	29.00	28.00	20.00	25.00	27.00	22.00	25.00
19	24.00	28.00	29.00	28.00	25.00	24.00	25.00	26.00	24.00	25.00
20	23.00	27.00	23.00	30.00	23.00	21.00	27.00	22.00	24.00	29.00

**HISTOGRAMA DE LO DATOS RECOLECTADOS**





**CALCULO DEL RANGO "D"**

Se depuran un total de 10% de los datos siendo 5% por cada extremo del histograma

Lado izquierdo	
Valor a dividir (di) =	<b>5</b>
Existente (ei) =	<b>6</b>
Faltante (fi) =	<b>4</b>

Lado derecho	
Valor a dividir (dd) =	<b>8</b>
Existente (ed) =	<b>5</b>
Faltante (fd) =	<b>5</b>

N° de intervalos

Rango medio (dm) = **8**

Entonces "D" viene a ser:

$$D = \left( \frac{(d_i - f_i)}{d_i} + d_m + \frac{(d_d - f_d)}{d_d} \right) * 5 [mm]$$

D= 42.88 mm

**CÁLCULO FACTOR DE CORRECCIÓN fc:**

Donde:

- Ep = 6.2
- Li = 25
- Lf = 15

$$f_c = \left( \frac{(E_p * 10)}{(L_i - L_f) * 5} \right)$$

fc = 1.24 mm

**CÁLCULO DEL RANGO CORREGIDO Dc:**

$$D_c = D * f_c$$

Dc = 53.165 mm

**DETERMINACIÓN DEL I.R.I.:**

Para pavimentos nuevos:

I. R. I. =  $0.0485 * D_c$

→ (IRI < 2.4)

Para pavimentos en servicio:

I. R. I. =  $0.593 + 0.0471 * D_c$

→ (2.4 < IRI < 15.9)

**CÁLCULO DEL I.R.I.:**

Aplicando la fórmula para pavimentos en servicio:

I. R. I. =  $0.593 + 0.0471 * D_c$

**I.R.I. = 3.10 m/km**





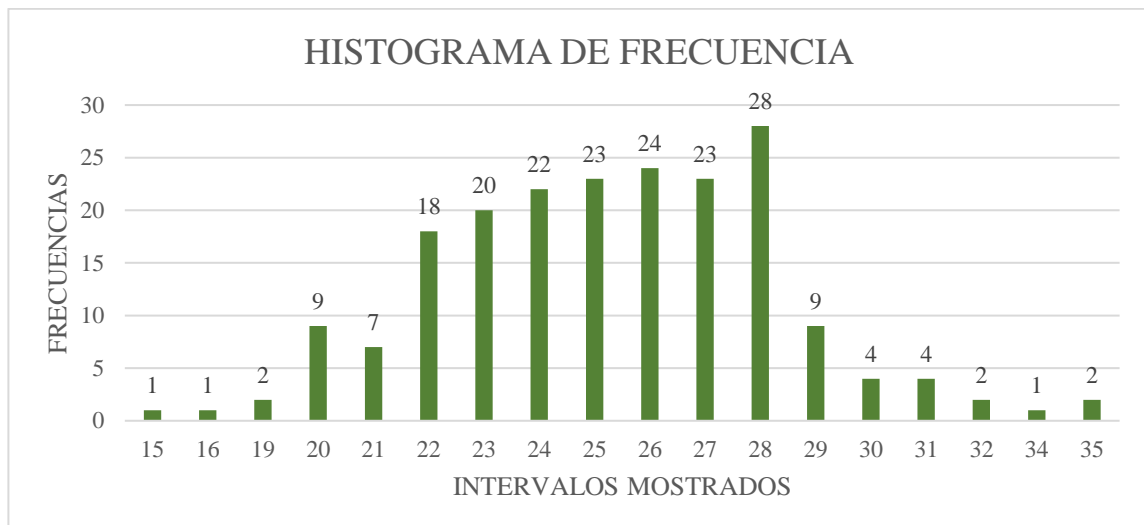
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**FACULTAD CIENCIAS Y TECNOLOGÍA**  
**DPTO. DE TOPOGRAFIA Y VÍAS DE COMUNICACIÓN**  
**CARRERA DE INGENIERIA CIVIL**  
**LABORATORIO DE ASFALTOS**

**Nombre del tramo:** El Portillo-La Pintada (Cruce Ruta 11 Villamontes - Entrada al proyecto múltiples san jacinto - oficinas)

**Carril de vuelta** Progresiva: 0+800 a 0+400

	1	2	3	4	5	6	7	8	9	10
1	28.00	28.00	25.00	29.00	20.00	25.00	26.00	27.00	28.00	21.00
2	25.00	32.00	28.00	23.00	20.00	24.00	23.00	22.00	27.00	22.00
3	23.00	28.00	23.00	25.00	26.00	22.00	27.00	25.00	27.00	27.00
4	25.00	23.00	27.00	28.00	23.00	23.00	27.00	26.00	24.00	22.00
5	27.00	25.00	27.00	21.00	28.00	25.00	24.00	29.00	28.00	24.00
6	20.00	26.00	23.00	24.00	25.00	15.00	28.00	29.00	21.00	27.00
7	22.00	21.00	22.00	24.00	25.00	28.00	28.00	24.00	20.00	29.00
8	28.00	25.00	25.00	22.00	22.00	26.00	25.00	28.00	21.00	24.00
9	26.00	26.00	23.00	20.00	27.00	27.00	27.00	24.00	26.00	29.00
10	29.00	23.00	31.00	26.00	28.00	28.00	24.00	27.00	22.00	25.00
11	27.00	23.00	26.00	26.00	25.00	28.00	16.00	27.00	22.00	21.00
12	30.00	24.00	26.00	27.00	22.00	26.00	28.00	23.00	20.00	29.00
13	24.00	28.00	24.00	24.00	23.00	20.00	32.00	27.00	31.00	24.00
14	28.00	28.00	31.00	30.00	20.00	24.00	24.00	26.00	26.00	28.00
15	28.00	25.00	29.00	25.00	22.00	26.00	26.00	28.00	26.00	28.00
16	21.00	20.00	31.00	25.00	24.00	25.00	27.00	28.00	24.00	35.00
17	22.00	23.00	24.00	26.00	23.00	26.00	26.00	23.00	26.00	35.00
18	22.00	23.00	26.00	28.00	25.00	22.00	22.00	22.00	28.00	27.00
19	23.00	28.00	30.00	24.00	29.00	24.00	25.00	23.00	25.00	27.00
20	19.00	26.00	22.00	27.00	30.00	25.00	19.00	27.00	23.00	34.00

**HISTOGRAMA DE LO DATOS RECOLECTADOS**





**CALCULO DEL RANGO "D"**

Se depuran un total de 10% de los datos siendo 5% por cada extremo del histograma

Lado izquierdo	
Valor a dividir (di) =	<b>9</b>
Existente (ei) =	4
Faltante (fi) =	<b>6</b>

Lado derecho	
Valor a dividir (dd) =	<b>4</b>
Existente (ed) =	9
Faltante (fd) =	<b>1</b>

N° de intervalos

Rango medio (dm) = **6**

Entonces "D" viene a ser:

$$D = \left( \frac{(d_i - f_i)}{d_i} + d_m + \frac{(d_d - f_d)}{d_d} \right) * 5 [mm]$$

D= 50.42 mm

**CÁLCULO FACTOR DE CORRECCIÓN fc:**

Donde:

Ep = 6.2  
 Li = 25  
 Lf = 15

$$f_c = \left( \frac{(E_p * 10)}{(L_i - L_f) * 5} \right)$$

fc = 1.24 mm

**CÁLCULO DEL RANGO CORREGIDO Dc:**

$$D_c = D * f_c$$

Dc = 62.52 mm

**DETERMINACIÓN DEL I.R.I.:**

Para pavimentos nuevos:

$$I.R.I. = 0.0485 * D_c$$

→ (IRI < 2.4)

Para pavimentos en servicio:

$$I.R.I. = 0.593 + 0.0471 * D_c$$

→ (2.4 < IRI < 15.9)

**CÁLCULO DEL I.R.I.:**

Aplicando la fórmula para pavimentos en servicio:

$$I.R.I. = 0.593 + 0.0471 * D_c$$

**I.R.I. = 3.54 m/km**



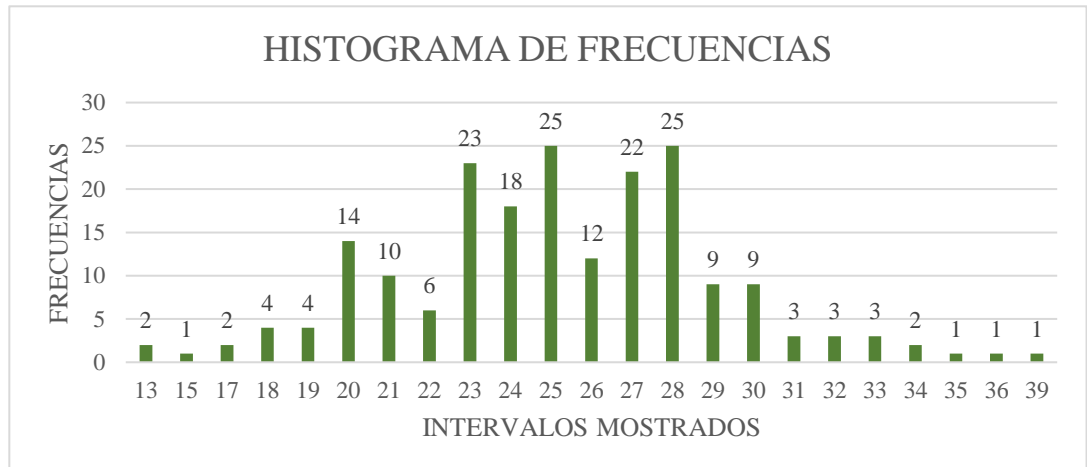
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 LABORATORIO DE ASFALTOS

**Nombre del tramo:** El Portillo-La Pintada (Cruce Ruta 11 Villamontes - Entrada al proyecto múltiples san jacinto - oficinas)

**Carril de vuelta** Progresiva: 0+400 a 0+000

	1	2	3	4	5	6	7	8	9	10
1	23.00	22.00	27.00	24.00	28.00	20.00	28.00	28.00	28.00	20.00
2	27.00	26.00	25.00	26.00	20.00	34.00	28.00	31.00	24.00	25.00
3	21.00	28.00	25.00	39.00	25.00	30.00	19.00	28.00	28.00	29.00
4	25.00	26.00	25.00	36.00	25.00	21.00	20.00	33.00	28.00	28.00
5	25.00	28.00	28.00	28.00	29.00	30.00	27.00	30.00	24.00	24.00
6	27.00	21.00	27.00	29.00	28.00	17.00	30.00	29.00	25.00	21.00
7	23.00	27.00	25.00	23.00	30.00	22.00	23.00	23.00	23.00	18.00
8	23.00	23.00	25.00	24.00	27.00	27.00	21.00	27.00	17.00	26.00
9	23.00	25.00	23.00	26.00	28.00	32.00	29.00	30.00	25.00	23.00
10	30.00	21.00	24.00	23.00	15.00	24.00	27.00	27.00	19.00	27.00
11	22.00	30.00	27.00	29.00	23.00	25.00	27.00	20.00	28.00	25.00
12	25.00	23.00	26.00	24.00	23.00	22.00	24.00	27.00	23.00	28.00
13	29.00	27.00	26.00	27.00	20.00	29.00	23.00	27.00	23.00	20.00
14	23.00	24.00	19.00	28.00	24.00	34.00	23.00	24.00	25.00	20.00
15	24.00	25.00	33.00	18.00	26.00	25.00	22.00	21.00	21.00	25.00
16	28.00	32.00	24.00	25.00	26.00	23.00	35.00	21.00	18.00	18.00
17	24.00	13.00	24.00	20.00	25.00	28.00	13.00	22.00	31.00	20.00
18	23.00	31.00	24.00	30.00	27.00	28.00	24.00	32.00	23.00	20.00
19	28.00	27.00	29.00	25.00	20.00	28.00	33.00	28.00	25.00	26.00
20	28.00	27.00	19.00	20.00	25.00	27.00	21.00	26.00	20.00	26.00

**HISTOGRAMA DE LO DATOS RECOLECTADOS**





**CALCULO DEL RANGO "D"**

Se depuran un total de 10% de los datos siendo 5% por cada extremo del histograma

Lado izquierdo	
Valor a dividir (di) =	<b>4</b>
Existente (ei) =	9
Faltante (fi) =	<b>1</b>

Lado derecho	
Valor a dividir (dd) =	<b>3</b>
Existente (ed) =	8
Faltante (fd) =	<b>2</b>

N° de intervalos

Rango medio (dm) = **12**

Entonces "D" viene a ser:

$$D = \left( \frac{(d_i - f_i)}{d_i} + d_m + \frac{(d_a - f_a)}{d_a} \right) * 5 [mm]$$

$$D = 65.42 \text{ mm}$$

**CÁLCULO FACTOR DE CORRECCIÓN fc:**

Donde:

$$\begin{aligned} E_p &= 6.2 \\ L_i &= 25 \\ L_f &= 15 \end{aligned}$$

$$f_c = \left( \frac{(E_p * 10)}{(L_i - L_f) * 5} \right)$$

$$f_c = 1.24 \text{ mm}$$

**CÁLCULO DEL RANGO CORREGIDO Dc:**

$$D_c = D * f_c$$

$$D_c = 81.12 \text{ mm}$$

**DETERMINACIÓN DEL I.R.I.:**

Para pavimentos nuevos:

$$I. R. I. = 0.0485 * D_c$$

→ (IRI < 2.4)

Para pavimentos en servicio:

$$I. R. I. = 0.593 + 0.0471 * D_c$$

→ (2.4 < IRI < 15.9)

**CÁLCULO DEL I.R.I.:**

Aplicando la fórmula para pavimentos en servicio:

$$I. R. I. = 0.593 + 0.0471 * D_c$$

$$I. R. I. = 4.41 \text{ m/km}$$



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 CARRERA DE INGENIERIA CIVIL  
 LABORATORIO DE ASFALTOS

**Nombre del laboratorista/tesista:** Alejandra Ramos Quispe

**Fecha de realización del ensayo:** 25-09-2022

**Número de muestra:** 4

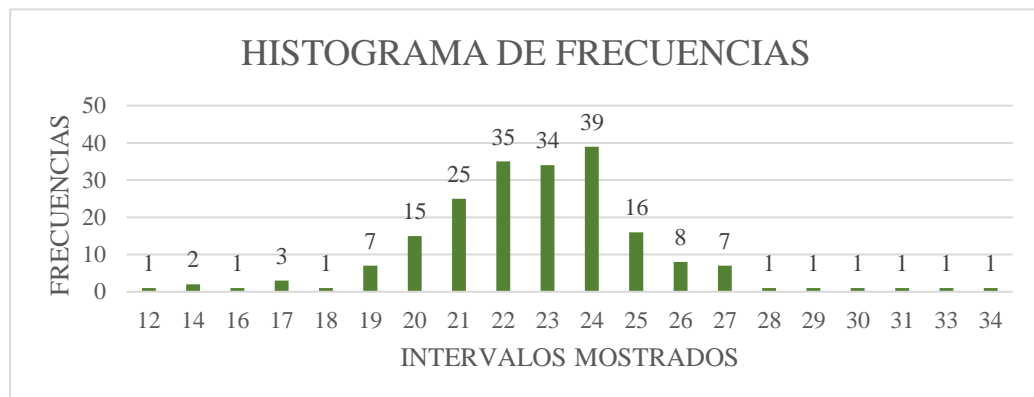
**Nombre del tramo:** Carretera San Mateo – Sella (Monte Méndez - Barrio El Taco)

**Carril de ida** Progresiva: 0+000 a 0+400

### Huella 1

	1	2	3	4	5	6	7	8	9	10
1	24.00	21.00	20.00	27.00	24.00	20.00	22.00	21.00	22.00	25.00
2	25.00	12.00	27.00	22.00	23.00	25.00	21.00	19.00	22.00	22.00
3	14.00	18.00	34.00	20.00	24.00	24.00	21.00	21.00	25.00	26.00
4	25.00	24.00	16.00	24.00	22.00	24.00	23.00	21.00	22.00	23.00
5	24.00	26.00	24.00	20.00	27.00	24.00	23.00	20.00	22.00	22.00
6	21.00	24.00	23.00	24.00	26.00	20.00	24.00	22.00	24.00	22.00
7	33.00	24.00	24.00	22.00	21.00	22.00	25.00	21.00	24.00	26.00
8	22.00	20.00	20.00	19.00	17.00	20.00	25.00	21.00	22.00	23.00
9	23.00	23.00	24.00	23.00	24.00	23.00	23.00	22.00	21.00	24.00
10	23.00	28.00	17.00	19.00	23.00	22.00	25.00	23.00	22.00	24.00
11	23.00	24.00	24.00	23.00	21.00	25.00	23.00	22.00	22.00	24.00
12	25.00	26.00	17.00	22.00	23.00	23.00	23.00	23.00	22.00	23.00
13	21.00	25.00	27.00	21.00	19.00	25.00	23.00	24.00	25.00	22.00
14	24.00	31.00	25.00	22.00	21.00	22.00	21.00	20.00	22.00	25.00
15	14.00	22.00	27.00	19.00	21.00	23.00	19.00	24.00	24.00	25.00
16	20.00	22.00	24.00	24.00	26.00	23.00	22.00	24.00	23.00	23.00
17	20.00	27.00	24.00	22.00	21.00	24.00	22.00	22.00	23.00	27.00
18	29.00	20.00	22.00	24.00	23.00	21.00	22.00	23.00	23.00	21.00
19	23.00	26.00	26.00	22.00	21.00	23.00	21.00	24.00	24.00	24.00
20	30.00	24.00	24.00	21.00	19.00	20.00	21.00	20.00	23.00	21.00

### HISTOGRAMA DE LO DATOS RECOLECTADOS





**CALCULO DEL RANGO "D"**

Se depuran un total de 10% de los datos siendo 5% por cada extremo del histograma

Lado izquierdo	
Valor a dividir (di) =	7
Existente (ei) =	8
Faltante (fi) =	2

Lado derecho	
Valor a dividir (dd) =	7
Existente (ed) =	6
Faltante (fd) =	4

N° de intervalos

Rango medio (dm) = 7

Entonces "D" viene a ser:

$$D = \left( \frac{(d_i - f_i)}{d_i} + d_m + \frac{(d_d - f_d)}{d_d} \right) * 5 [mm]$$

D= 40.71 mm

**CÁLCULO FACTOR DE CORRECCIÓN fc:**

Donde:

- Ep = 6.2
- Li = 25
- Lf = 15

$$f_c = \left( \frac{(E_p * 10)}{(L_i - L_f) * 5} \right)$$

fc = 1.24 mm

**CÁLCULO DEL RANGO CORREGIDO Dc:**

$$D_c = D * f_c$$

Dc = 50.49 mm

**DETERMINACIÓN DEL I.R.I.:**

Para pavimentos nuevos:

$$I.R.I. = 0.0485 * D_c$$

⇒ (IRI < 2.4)

Para pavimentos en servicio:

$$I.R.I. = 0.593 + 0.0471 * D_c$$

⇒ (2.4 < IRI < 15.9)

**CÁLCULO DEL I.R.I.:**

Aplicando la fórmula para pavimentos en servicio:

$$I.R.I. = 0.593 + 0.0471 * D_c$$

I.R.I. = 2.97 m/km



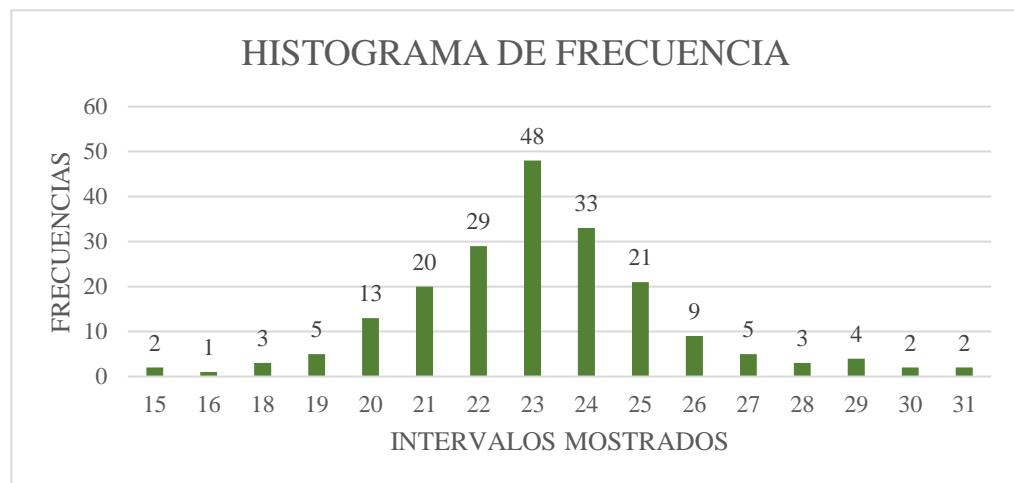
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CARRERA DE INGENIERIA CIVIL  
LABORATORIO DE ASFALTOS

Nombre del tramo: Carretera San Mateo – Sella (Monte Méndez - Barrio El Taco)

Carril de ida Progresiva: 0+400 a 0+800

	1	2	3	4	5	6	7	8	9	10
1	22.00	21.00	23.00	25.00	24.00	21.00	26.00	23.00	23.00	19.00
2	29.00	21.00	24.00	26.00	23.00	30.00	22.00	22.00	23.00	24.00
3	25.00	24.00	22.00	22.00	22.00	20.00	26.00	22.00	22.00	23.00
4	22.00	25.00	25.00	23.00	23.00	29.00	27.00	20.00	18.00	24.00
5	26.00	21.00	24.00	23.00	24.00	23.00	28.00	21.00	24.00	23.00
6	21.00	30.00	27.00	21.00	26.00	26.00	21.00	25.00	24.00	19.00
7	23.00	25.00	23.00	23.00	26.00	24.00	28.00	25.00	21.00	25.00
8	20.00	23.00	24.00	19.00	21.00	27.00	22.00	23.00	27.00	23.00
9	28.00	20.00	23.00	20.00	25.00	24.00	21.00	18.00	24.00	24.00
10	22.00	31.00	25.00	24.00	23.00	21.00	24.00	23.00	23.00	24.00
11	25.00	25.00	22.00	25.00	23.00	18.00	22.00	24.00	25.00	21.00
12	23.00	20.00	16.00	20.00	24.00	21.00	22.00	23.00	21.00	23.00
13	23.00	22.00	25.00	24.00	24.00	24.00	20.00	23.00	23.00	23.00
14	21.00	23.00	25.00	19.00	24.00	24.00	23.00	22.00	20.00	23.00
15	21.00	22.00	23.00	22.00	15.00	21.00	24.00	24.00	24.00	24.00
16	23.00	23.00	22.00	23.00	22.00	24.00	23.00	25.00	23.00	25.00
17	23.00	21.00	22.00	29.00	23.00	22.00	23.00	22.00	24.00	20.00
18	22.00	25.00	23.00	15.00	22.00	21.00	23.00	20.00	24.00	22.00
19	23.00	23.00	19.00	23.00	20.00	27.00	29.00	26.00	25.00	22.00
20	23.00	26.00	22.00	24.00	23.00	25.00	24.00	31.00	22.00	20.00

### HISTOGRAMA DE LO DATOS RECOLECTADOS





**CALCULO DEL RANGO "D"**

Se depuran un total de 10% de los datos siendo 5% por cada extremo del histograma

Lado izquierdo	
Valor a dividir (di) =	5
Existente (ei) =	6
Faltante (fi) =	4

Lado derecho	
Valor a dividir (dd) =	3
Existente (ed) =	8
Faltante (fd) =	2

Nº de intervalos

Rango medio (dm) = 8

Entonces "D" viene a ser:

$$D = \left( \frac{(d_i - f_i)}{d_i} + d_m + \frac{(d_d - f_d)}{d_d} \right) * 5 [mm]$$

D= 42.67 mm

**CÁLCULO FACTOR DE CORRECCIÓN fc:**

Donde:

- Ep = 6.2
- Li = 25
- Lf = 15

$$f_c = \left( \frac{(E_p * 10)}{(L_i - L_f) * 5} \right)$$

fc = 1.24 mm

**CÁLCULO DEL RANGO CORREGIDO Dc:**

$$D_c = D * f_c$$

Dc = 52.91 mm

**DETERMINACIÓN DEL I.R.I.:**

Para pavimentos nuevos:

I. R. I. = 0.0485 \* Dc → (IRI < 2.4)

Para pavimentos en servicio:

I. R. I. = 0.593 + 0.0471 \* Dc → (2.4 < IRI < 15.9)

**CÁLCULO DEL I.R.I.:**

Aplicando la fórmula para pavimentos en servicio:

I. R. I. = 0.593 + 0.0471 \* Dc

I.R.I.= 3.08 m/km





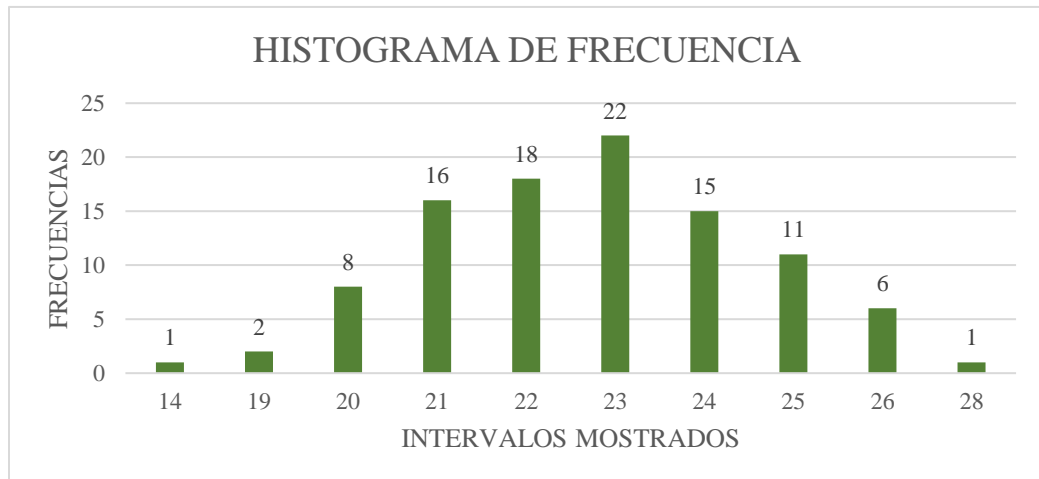
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**LABORATORIO DE ASFALTOS**

**Nombre del tramo:** Carretera San Mateo – Sella (Monte Méndez - Barrio El Taco)

**Carril de ida** Progresiva: 0+800 a 1+000

	1	2	3	4	5	6	7	8	9	10
1	25.00	23.00	21.00	21.00	23.00	28.00	21.00	25.00	27.00	25.00
2	22.00	22.00	21.00	24.00	25.00	29.00	27.00	26.00	23.00	25.00
3	20.00	21.00	26.00	23.00	24.00	25.00	27.00	27.00	30.00	30.00
4	23.00	23.00	20.00	21.00	26.00	30.00	27.00	28.00	25.00	25.00
5	20.00	14.00	22.00	22.00	22.00	25.00	24.00	27.00	24.00	25.00
6	23.00	19.00	20.00	21.00	23.00	26.00	28.00	27.00	26.00	27.00
7	22.00	23.00	23.00	25.00	25.00	28.00	26.00	26.00	28.00	27.00
8	22.00	21.00	24.00	22.00	24.00	28.00	32.00	27.00	25.00	25.00
9	20.00	24.00	20.00	26.00	24.00	27.00	30.00	28.00	27.00	25.00
10	23.00	24.00	20.00	22.00	25.00	28.00	27.00	28.00	28.00	29.00
11	20.00	24.00	26.00	24.00	22.00	33.00	29.00	26.00	26.00	29.00
12	23.00	21.00	21.00	25.00	24.00	26.00	28.00	22.00	26.00	25.00
13	19.00	21.00	23.00	22.00	24.00	32.00	26.00	25.00	25.00	27.00
14	25.00	21.00	22.00	25.00	23.00	26.00	28.00	28.00	27.00	24.00
15	24.00	21.00	24.00	23.00	22.00	29.00	25.00	27.00	26.00	26.00
16	23.00	23.00	23.00	23.00	21.00	28.00	27.00	28.00	25.00	23.00
17	22.00	22.00	25.00	23.00	23.00	28.00	23.00	26.00	28.00	27.00
18	22.00	26.00	23.00	24.00	25.00	28.00	29.00	28.00	26.00	27.00
19	24.00	22.00	21.00	25.00	26.00	25.00	27.00	26.00	27.00	27.00
20	21.00	23.00	21.00	28.00	22.00	28.00	25.00	25.00	26.00	23.00

**HISTOGRAMA DE LO DATOS RECOLECTADOS**





**CALCULO DEL RANGO "D"**

Se depuran un total de 10% de los datos siendo 5% por cada extremo del histograma

<b>Lado izquierdo</b>	
Valor a dividir (di) =	<b>8</b>
Existente (ei) =	3
Faltante (fi) =	<b>7</b>

<b>Lado derecho</b>	
Valor a dividir (dd) =	<b>11</b>
Existente (ed) =	7
Faltante (fd) =	<b>3</b>

N° de intervalos

Rango medio (dm) = **4**

Entonces "D" viene a ser:

$$D = \left( \frac{(d_i - f_i)}{d_i} + d_m + \frac{(d_d - f_d)}{d_d} \right) * 5 [mm]$$

D= 24.26 mm

**CÁLCULO FACTOR DE CORRECCIÓN fc:**

Donde:

Ep = 6.2  
 Li = 25  
 Lf = 15

$$f_c = \left( \frac{(E_p * 10)}{(L_i - L_f) * 5} \right)$$

fc = 1.24 mm

**CÁLCULO DEL RANGO CORREGIDO Dc:**

$$D_c = D * f_c$$

Dc = 30.08 mm

**DETERMINACIÓN DEL I.R.I.:**

Para pavimentos nuevos:

$$I.R.I. = 0.0485 * D_c$$

→ (IRI < 2.4)

Para pavimentos en servicio:

$$I.R.I. = 0.593 + 0.0471 * D_c$$

→ (2.4 < IRI < 15.9)

**CÁLCULO DEL I.R.I.:**

Aplicando la fórmula para pavimentos en servicio:

$$I.R.I. = 0.593 + 0.0471 * D_c$$

**I.R.I. = 2.01 m/km**



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**CARRERA DE INGENIERIA CIVIL**  
**LABORATORIO DE ASFALTOS**

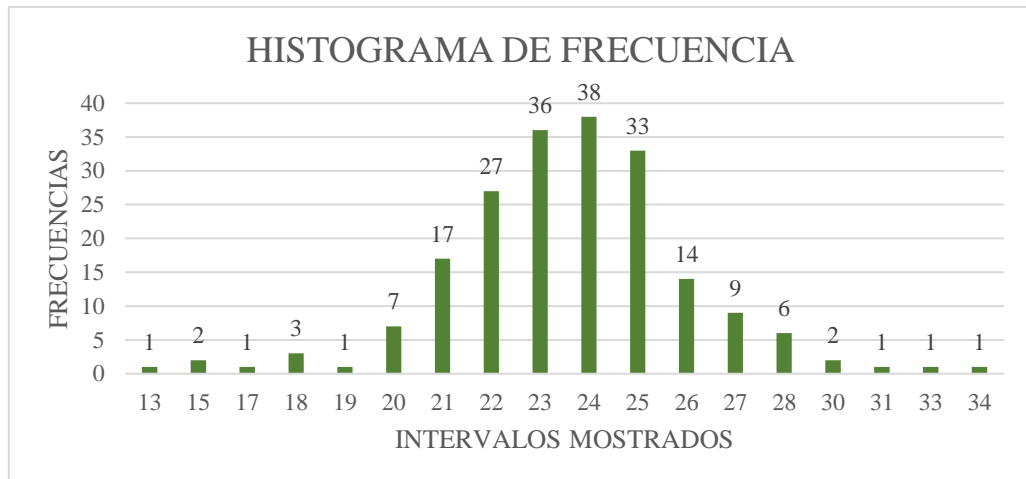
**Nombre del tramo:** Carretera San Mateo – Sella (Monte Méndez - Barrio El Taco)

**Carril de ida** Progresiva: 0+000 a 0+400

**Huella 2**

	1	2	3	4	5	6	7	8	9	10
1	25.00	22.00	21.00	28.00	25.00	21.00	23.00	22.00	23.00	26.00
2	26.00	13.00	28.00	23.00	24.00	26.00	22.00	20.00	22.00	23.00
3	15.00	19.00	34.00	21.00	25.00	25.00	21.00	22.00	26.00	27.00
4	26.00	25.00	17.00	25.00	23.00	24.00	24.00	22.00	23.00	24.00
5	24.00	26.00	25.00	21.00	27.00	25.00	24.00	21.00	23.00	23.00
6	22.00	25.00	24.00	25.00	27.00	21.00	25.00	23.00	25.00	22.00
7	33.00	24.00	25.00	23.00	22.00	23.00	26.00	22.00	24.00	27.00
8	23.00	21.00	21.00	20.00	18.00	21.00	25.00	21.00	23.00	24.00
9	24.00	24.00	25.00	23.00	25.00	24.00	24.00	23.00	22.00	25.00
10	24.00	28.00	18.00	20.00	24.00	23.00	26.00	24.00	23.00	24.00
11	23.00	25.00	24.00	24.00	22.00	25.00	24.00	23.00	22.00	25.00
12	26.00	27.00	18.00	23.00	24.00	24.00	23.00	24.00	23.00	24.00
13	22.00	26.00	28.00	22.00	20.00	26.00	24.00	25.00	26.00	23.00
14	25.00	31.00	26.00	23.00	22.00	23.00	22.00	21.00	23.00	25.00
15	15.00	23.00	28.00	20.00	22.00	24.00	20.00	25.00	25.00	26.00
16	21.00	23.00	25.00	24.00	27.00	23.00	23.00	24.00	24.00	24.00
17	21.00	28.00	24.00	23.00	22.00	25.00	22.00	23.00	24.00	27.00
18	30.00	21.00	23.00	25.00	24.00	22.00	23.00	24.00	23.00	22.00
19	24.00	27.00	27.00	23.00	22.00	24.00	22.00	25.00	25.00	25.00
20	30.00	25.00	25.00	22.00	20.00	21.00	22.00	21.00	24.00	22.00

**HISTOGRAMA DE LO DATOS RECOLECTADOS**





**CALCULO DEL RANGO "D"**

Se depuran un total de 10% de los datos siendo 5% por cada extremo del histograma

Lado izquierdo	
Valor a dividir (di) =	7
Existente (ei) =	8
Faltante (fi) =	2

Lado derecho	
Valor a dividir (dd) =	6
Existente (ed) =	5
Faltante (fd) =	5

N° de intervalos

Rango medio (dm) = 7

Entonces "D" viene a ser:

$$D = \left( \frac{(d_i - f_i)}{d_i} + d_m + \frac{(d_d - f_d)}{d_d} \right) * 5 \text{ [mm]}$$

D= 39.40 mm

**CÁLCULO FACTOR DE CORRECCIÓN fc:**

Donde:

Ep = 6.2  
 Li = 25  
 Lf = 15

$$f_c = \left( \frac{(E_p * 10)}{(L_i - L_f) * 5} \right)$$

fc = 1.24 mm

**CÁLCULO DEL RANGO CORREGIDO Dc:**

$$D_c = D * f_c$$

Dc = 48.86 mm

**DETERMINACIÓN DEL I.R.I.:**

Para pavimentos nuevos:

$$I. R. I. = 0.0485 * D_c$$

→ (IRI<2.4)

Para pavimentos en servicio:

$$I. R. I. = 0.593 + 0.0471 * D_c$$

→ (2.4<IRI<15.9)

**CÁLCULO DEL I.R.I.:**

Aplicando la fórmula para pavimentos en servicio:

$$I. R. I. = 0.593 + 0.0471 * D_c$$

I.R.I.= 2.89 m/km



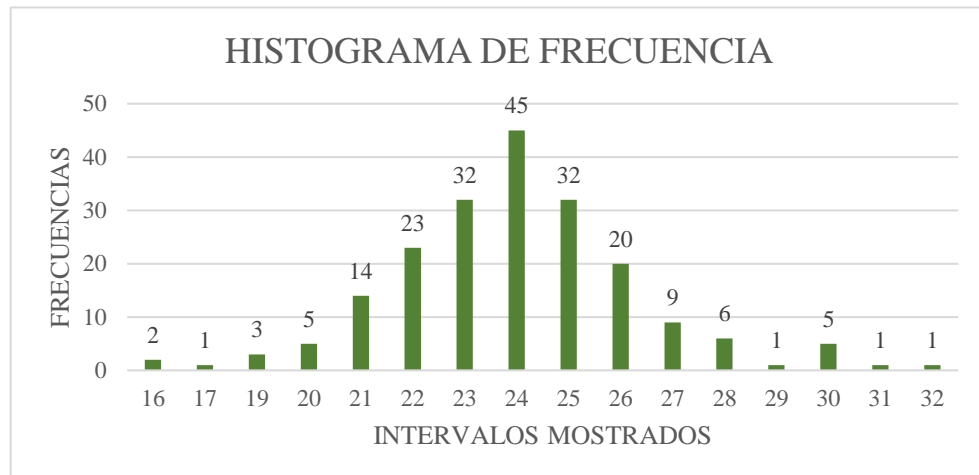
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**DPTO. DE TOPOGRAFIA Y VÍAS DE COMUNICACIÓN**  
**CARRERA DE INGENIERIA CIVIL**  
**LABORATORIO DE ASFALTOS**

**Nombre del tramo:** Carretera San Mateo – Sella (Monte Méndez - Barrio El Taco)

**Carril de ida** Progresiva: 0+400 a 0+800

	1	2	3	4	5	6	7	8	9	10
1	23.00	22.00	24.00	26.00	25.00	22.00	27.00	24.00	24.00	20.00
2	30.00	21.00	25.00	27.00	24.00	31.00	23.00	23.00	23.00	25.00
3	26.00	25.00	23.00	23.00	23.00	21.00	27.00	22.00	23.00	24.00
4	23.00	26.00	26.00	24.00	24.00	30.00	28.00	21.00	19.00	25.00
5	27.00	22.00	25.00	24.00	25.00	24.00	29.00	22.00	25.00	24.00
6	22.00	30.00	27.00	22.00	26.00	27.00	22.00	26.00	25.00	20.00
7	24.00	26.00	24.00	24.00	27.00	25.00	28.00	25.00	22.00	26.00
8	21.00	24.00	25.00	20.00	22.00	28.00	23.00	24.00	28.00	24.00
9	28.00	21.00	24.00	21.00	26.00	25.00	22.00	19.00	25.00	25.00
10	23.00	32.00	26.00	25.00	24.00	22.00	25.00	24.00	24.00	24.00
11	26.00	26.00	23.00	26.00	23.00	19.00	23.00	25.00	25.00	22.00
12	24.00	21.00	17.00	21.00	25.00	22.00	22.00	24.00	22.00	24.00
13	23.00	23.00	26.00	25.00	25.00	25.00	21.00	23.00	24.00	23.00
14	22.00	24.00	25.00	20.00	24.00	24.00	24.00	23.00	21.00	24.00
15	22.00	23.00	24.00	22.00	16.00	22.00	25.00	25.00	25.00	25.00
16	24.00	24.00	23.00	24.00	23.00	25.00	24.00	26.00	24.00	26.00
17	23.00	22.00	22.00	30.00	24.00	23.00	23.00	23.00	25.00	21.00
18	23.00	26.00	24.00	16.00	23.00	22.00	24.00	21.00	24.00	23.00
19	24.00	24.00	20.00	24.00	21.00	28.00	30.00	27.00	26.00	23.00
20	24.00	27.00	23.00	25.00	24.00	26.00	25.00	26.00	23.00	21.00

**HISTOGRAMA DE LO DATOS RECOLECTADOS**





**CALCULO DEL RANGO "D"**

Se depuran un total de 10% de los datos siendo 5% por cada extremo del histograma

<b>Lado izquierdo</b>	
Valor a dividir (di) =	<b>5</b>
Existente (ei) =	<b>6</b>
Faltante (fi) =	<b>4</b>

<b>Lado derecho</b>	
Valor a dividir (dd) =	<b>6</b>
Existente (ed) =	<b>8</b>
Faltante (fd) =	<b>2</b>

N° de intervalos

Rango medio (dm) = **7**

Entonces "D" viene a ser:

$$D = \left( \frac{(d_i - f_i)}{d_i} + d_m + \frac{(d_d - f_d)}{d_d} \right) * 5 [mm]$$

D= 39.33 mm

**CÁLCULO FACTOR DE CORRECCIÓN fc:**

Donde:

- Ep = 6.2
- Li = 25
- Lf = 15

$$f_c = \left( \frac{(E_p * 10)}{(L_i - L_f) * 5} \right)$$

fc = 1.24 mm

**CÁLCULO DEL RANGO CORREGIDO Dc:**

$$D_c = D * f_c$$

Dc = 48.77 mm

**DETERMINACIÓN DEL I.R.I.:**

Para pavimentos nuevos:

I.R.I. = 0.0485 \* D<sub>c</sub>

→ (IRI < 2.4)

Para pavimentos en servicio:

I.R.I. = 0.593 + 0.0471 \* D<sub>c</sub>

→ (2.4 < IRI < 15.9)

**CÁLCULO DEL I.R.I.:**

Aplicando la fórmula para pavimentos en servicio:

I.R.I. = 0.593 + 0.0471 \* D<sub>c</sub>

**I.R.I. = 2.89 m/km**



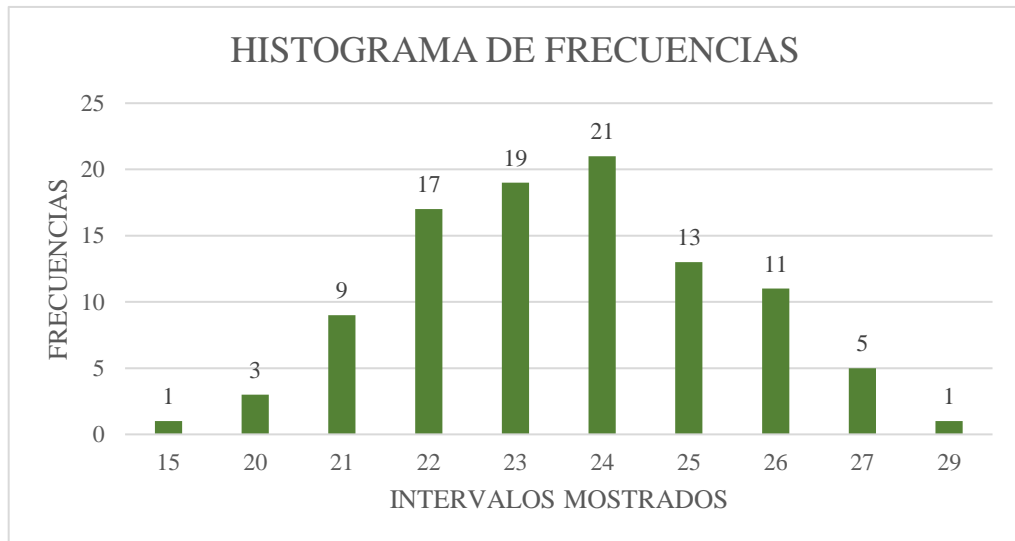
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**CARRERA DE INGENIERIA CIVIL**  
**LABORATORIO DE ASFALTOS**

**Nombre del tramo:** Carretera San Mateo – Sella (Monte Méndez - Barrio El Taco)

**Carril de ida** Progresiva: 0+800 a 1+000

	1	2	3	4	5	6	7	8	9	10
1	26.00	24.00	22.00	22.00	24.00	29.00	22.00	26.00	28.00	26.00
2	23.00	23.00	22.00	25.00	26.00	30.00	28.00	27.00	24.00	25.00
3	21.00	22.00	27.00	24.00	25.00	26.00	27.00	28.00	30.00	31.00
4	24.00	23.00	21.00	22.00	26.00	30.00	28.00	29.00	26.00	26.00
5	20.00	15.00	23.00	23.00	23.00	26.00	25.00	28.00	25.00	26.00
6	21.00	20.00	21.00	22.00	23.00	27.00	28.00	27.00	27.00	28.00
7	23.00	24.00	24.00	26.00	26.00	29.00	29.00	27.00	29.00	27.00
8	22.00	22.00	25.00	23.00	25.00	28.00	33.00	28.00	26.00	26.00
9	21.00	25.00	21.00	27.00	24.00	28.00	31.00	29.00	28.00	26.00
10	24.00	24.00	21.00	23.00	26.00	29.00	28.00	28.00	29.00	30.00
11	21.00	25.00	27.00	25.00	23.00	34.00	29.00	27.00	27.00	30.00
12	24.00	22.00	22.00	26.00	25.00	27.00	29.00	23.00	26.00	26.00
13	20.00	22.00	24.00	23.00	24.00	33.00	27.00	26.00	26.00	27.00
14	26.00	21.00	23.00	26.00	24.00	27.00	29.00	29.00	28.00	25.00
15	25.00	22.00	25.00	24.00	23.00	30.00	26.00	28.00	27.00	27.00
16	24.00	24.00	24.00	24.00	22.00	29.00	28.00	29.00	25.00	24.00
17	23.00	23.00	25.00	23.00	24.00	29.00	24.00	27.00	29.00	28.00
18	22.00	27.00	24.00	25.00	26.00	28.00	29.00	28.00	27.00	27.00
19	25.00	23.00	22.00	26.00	27.00	26.00	28.00	27.00	28.00	28.00
20	22.00	24.00	22.00	29.00	23.00	29.00	26.00	26.00	27.00	24.00

**HISTOGRAMA DE LO DATOS RECOLECTADOS**





**CALCULO DEL RANGO "D"**

Se depuran un total de 10% de los datos siendo 5% por cada extremo del histograma

Lado izquierdo	
Valor a dividir (di) =	9
Existente (ei) =	4
Faltante (fi) =	6

Lado derecho	
Valor a dividir (dd) =	11
Existente (ed) =	6
Faltante (fd) =	4

Nº de intervalos

Rango medio (dm) = 4

Entonces "D" viene a ser:

$$D = \left( \frac{(d_i - f_i)}{d_i} + d_m + \frac{(d_d - f_d)}{d_d} \right) * 5 [mm]$$

D= 24.85 mm

**CÁLCULO FACTOR DE CORRECCIÓN fc:**

Donde:

Ep = 6.2  
 Li = 25  
 Lf = 15

$$f_c = \left( \frac{(E_p * 10)}{(L_i - L_f) * 5} \right)$$

fc = 1.24 mm

**CÁLCULO DEL RANGO CORREGIDO Dc:**

$$D_c = D * f_c$$

Dc = 30.81 mm

**DETERMINACIÓN DEL I.R.I.:**

Para pavimentos nuevos:

I. R. I. = 0.0485 \* D<sub>c</sub>      ⇒      (IRI < 2.4)

Para pavimentos en servicio:

I. R. I. = 0.593 + 0.0471 \* D<sub>c</sub>      ⇒      (2.4 < IRI < 15.9)

**CÁLCULO DEL I.R.I.:**

Aplicando la fórmula para pavimentos en servicio:

I. R. I. = 0.593 + 0.0471 \* D<sub>c</sub>

I.R.I.= 2.04 m/km





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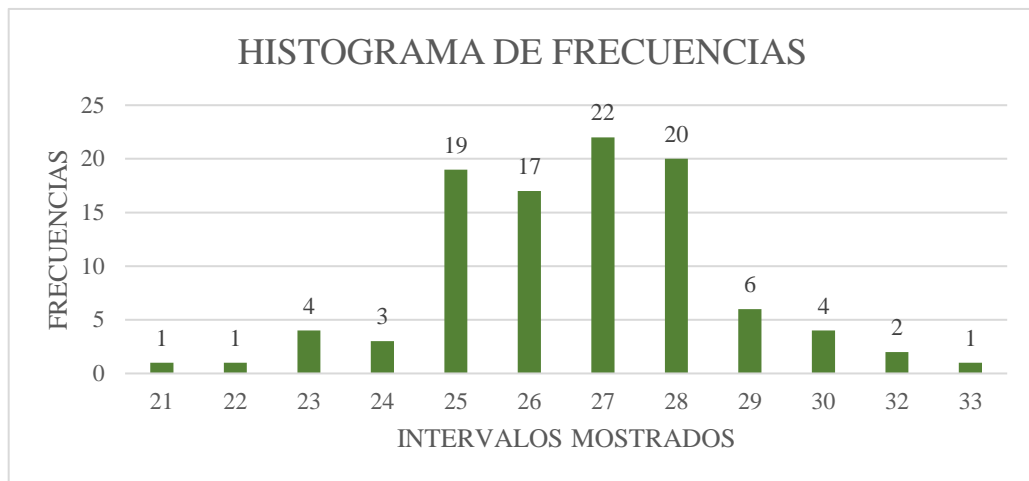
**Nombre del tramo:** Carretera San Mateo – Sella (Monte Méndez - Barrio El Taco)

**Carril de vuelta** Progresiva: 1+000 a 0+800

**Huella 1**

	1	2	3	4	5	6	7	8	9	10
1	25.00	23.00	21.00	21.00	23.00	28.00	21.00	25.00	27.00	25.00
2	22.00	22.00	21.00	24.00	25.00	29.00	27.00	26.00	23.00	25.00
3	20.00	21.00	26.00	23.00	24.00	25.00	27.00	27.00	30.00	30.00
4	23.00	23.00	20.00	21.00	26.00	30.00	27.00	28.00	25.00	25.00
5	20.00	14.00	22.00	22.00	22.00	25.00	24.00	27.00	24.00	25.00
6	23.00	19.00	20.00	21.00	23.00	26.00	28.00	27.00	26.00	27.00
7	22.00	23.00	23.00	25.00	25.00	28.00	26.00	26.00	28.00	27.00
8	22.00	21.00	24.00	22.00	24.00	28.00	32.00	27.00	25.00	25.00
9	20.00	24.00	20.00	26.00	24.00	27.00	30.00	28.00	27.00	25.00
10	23.00	24.00	20.00	22.00	25.00	28.00	27.00	28.00	28.00	29.00
11	20.00	24.00	26.00	24.00	22.00	33.00	29.00	26.00	26.00	29.00
12	23.00	21.00	21.00	25.00	24.00	26.00	28.00	22.00	26.00	25.00
13	19.00	21.00	23.00	22.00	24.00	32.00	26.00	25.00	25.00	27.00
14	25.00	21.00	22.00	25.00	23.00	26.00	28.00	28.00	27.00	24.00
15	24.00	21.00	24.00	23.00	22.00	29.00	25.00	27.00	26.00	26.00
16	23.00	23.00	23.00	23.00	21.00	28.00	27.00	28.00	25.00	23.00
17	22.00	22.00	25.00	23.00	23.00	28.00	23.00	26.00	28.00	27.00
18	22.00	26.00	23.00	24.00	25.00	28.00	29.00	28.00	26.00	27.00
19	24.00	22.00	21.00	25.00	26.00	25.00	27.00	26.00	27.00	27.00
20	21.00	23.00	21.00	28.00	22.00	28.00	25.00	25.00	26.00	23.00

**HISTOGRAMA DE LO DATOS RECOLECTADOS**





**CALCULO DEL RANGO "D"**

Se depuran un total de 10% de los datos siendo 5% por cada extremo del histograma

<b>Lado izquierdo</b>	
Valor a dividir (di) =	<b>19</b>
Existente (ei) =	9
Faltante (fi) =	<b>1</b>

<b>Lado derecho</b>	
Valor a dividir (dd) =	<b>6</b>
Existente (ed) =	7
Faltante (fd) =	<b>3</b>

N° de intervalos

Rango medio (dm) = **3**

Entonces "D" viene a ser:

$$D = \left( \frac{(d_i - f_i)}{d_i} + d_m + \frac{(d_d - f_d)}{d_d} \right) * 5 [mm]$$

D= 22.24 mm

**CÁLCULO FACTOR DE CORRECCIÓN fc:**

Donde:

- Ep = 6.2
- Li = 25
- Lf = 15

$$f_c = \left( \frac{(E_p * 10)}{(L_i - L_f) * 5} \right)$$

fc = 1.24 mm

**CÁLCULO DEL RANGO CORREGIDO Dc:**

$$D_c = D * f_c$$

Dc = 27.57 mm

**DETERMINACIÓN DEL I.R.I.:**

Para pavimentos nuevos:

I. R. I. = 0.0485 \* D<sub>c</sub>

→ (IRI < 2.4)

Para pavimentos en servicio:

I. R. I. = 0.593 + 0.0471 \* D<sub>c</sub>

→ (2.4 < IRI < 15.9)

**CÁLCULO DEL I.R.I.:**

Aplicando la fórmula para pavimentos en servicio:

I. R. I. = 0.593 + 0.0471 \* D<sub>c</sub>

I.R.I. = 1.89 m/km



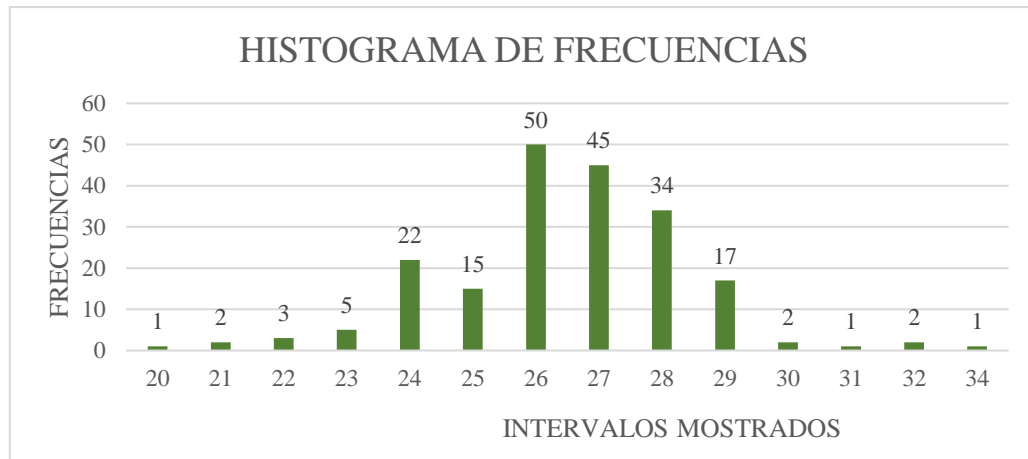
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**Nombre del tramo:** Carretera San Mateo – Sella (Monte Méndez - Barrio El Taco)

**Carril de vuelta** Progresiva: 0+800 a 0+400

	1	2	3	4	5	6	7	8	9	10
1	27.00	26.00	28.00	27.00	25.00	26.00	28.00	26.00	24.00	27.00
2	28.00	24.00	28.00	29.00	27.00	27.00	22.00	27.00	27.00	29.00
3	25.00	29.00	28.00	25.00	26.00	21.00	26.00	27.00	26.00	27.00
4	26.00	24.00	22.00	27.00	28.00	25.00	26.00	27.00	28.00	25.00
5	26.00	27.00	24.00	27.00	24.00	29.00	28.00	28.00	29.00	26.00
6	27.00	27.00	22.00	28.00	27.00	25.00	28.00	27.00	28.00	26.00
7	28.00	26.00	27.00	29.00	30.00	26.00	24.00	27.00	27.00	24.00
8	27.00	21.00	29.00	26.00	29.00	26.00	24.00	29.00	25.00	26.00
9	26.00	24.00	27.00	28.00	24.00	26.00	24.00	27.00	27.00	24.00
10	24.00	26.00	28.00	28.00	29.00	28.00	20.00	32.00	28.00	32.00
11	28.00	24.00	26.00	28.00	26.00	23.00	27.00	23.00	29.00	26.00
12	26.00	26.00	26.00	27.00	25.00	28.00	27.00	27.00	28.00	26.00
13	26.00	23.00	29.00	27.00	24.00	26.00	24.00	24.00	26.00	26.00
14	29.00	29.00	26.00	24.00	27.00	25.00	30.00	27.00	28.00	27.00
15	24.00	23.00	26.00	24.00	27.00	24.00	26.00	27.00	26.00	28.00
16	26.00	26.00	25.00	26.00	26.00	28.00	28.00	29.00	28.00	31.00
17	28.00	27.00	27.00	28.00	28.00	27.00	26.00	27.00	25.00	28.00
18	26.00	26.00	27.00	28.00	23.00	26.00	25.00	27.00	28.00	27.00
19	26.00	26.00	27.00	34.00	26.00	28.00	29.00	26.00	29.00	26.00
20	24.00	26.00	25.00	26.00	26.00	27.00	25.00	27.00	25.00	27.00

**HISTOGRAMA DE LO DATOS RECOLECTADOS**





**CALCULO DEL RANGO "D"**

Se depuran un total de 10% de los datos siendo 5% por cada extremo del histograma

Lado izquierdo	
Valor a dividir (di) =	5
Existente (ei) =	6
Faltante (fi) =	4

Lado derecho	
Valor a dividir (dd) =	17
Existente (ed) =	6
Faltante (fd) =	4

N° de intervalos

Rango medio (dm) = 5

Entonces "D" viene a ser:

$$D = \left( \frac{(d_i - f_i)}{d_i} + d_m + \frac{(d_d - f_d)}{d_d} \right) * 5 [mm]$$

D= 29.82 mm

**CÁLCULO FACTOR DE CORRECCIÓN fc:**

Donde:

Ep = 6.2

Li = 25

Lf = 15

$$f_c = \left( \frac{(E_p * 10)}{(L_i - L_f) * 5} \right)$$

fc = 1.24 mm

**CÁLCULO DEL RANGO CORREGIDO Dc:**

Dc = D \* fc

Dc = 36.98 mm

**DETERMINACIÓN DEL I.R.I.:**

Para pavimentos nuevos:

I. R. I. = 0.0485 \* Dc

⇒ (IRI < 2.4)

Para pavimentos en servicio:

I. R. I. = 0.593 + 0.0471 \* Dc

⇒ (2.4 < IRI < 15.9)

**CÁLCULO DEL I.R.I.:**

Aplicando la fórmula para pavimentos en servicio:

I. R. I. = 0.593 + 0.0471 \* Dc

I.R.I. = 2.33 m/km



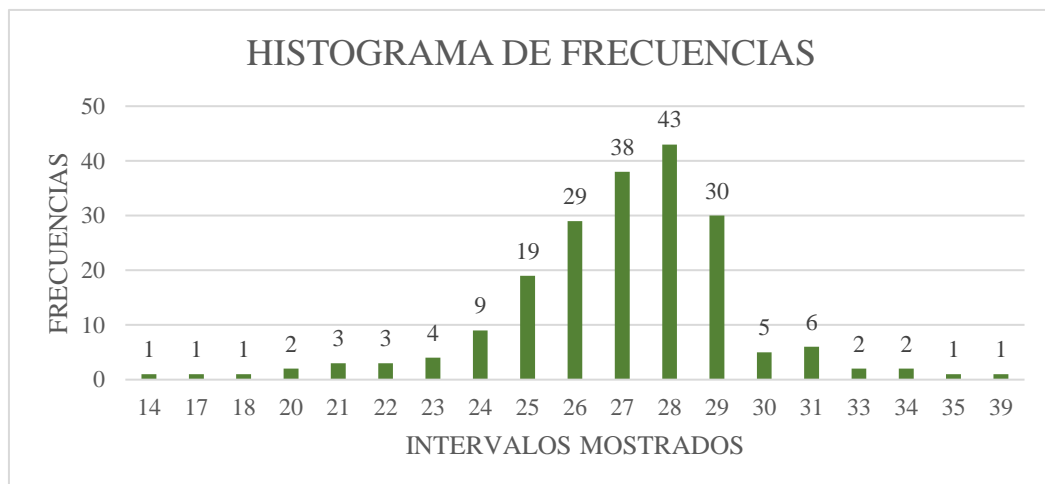
UNIVERSIDAD AUTÓNOMA JUAN MISAEL SARACHO  
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 DPTO. DE TOPOGRAFIA Y VÍAS DE COMUNICACIÓN  
 CARRERA DE INGENIERIA CIVIL  
 LABORATORIO DE ASFALTOS

**Nombre del tramo:** Carretera San Mateo – Sella (Monte Méndez - Barrio El Taco)

**Carril de vuelta** Progresiva: 0+400 a 0+000

	1	2	3	4	5	6	7	8	9	10
1	28.00	27.00	29.00	25.00	24.00	28.00	28.00	31.00	29.00	29.00
2	28.00	28.00	28.00	25.00	29.00	26.00	27.00	28.00	28.00	28.00
3	26.00	25.00	26.00	24.00	30.00	26.00	29.00	29.00	30.00	18.00
4	26.00	27.00	21.00	25.00	28.00	26.00	29.00	24.00	26.00	28.00
5	28.00	26.00	29.00	29.00	29.00	27.00	28.00	27.00	27.00	34.00
6	28.00	26.00	29.00	25.00	27.00	29.00	29.00	26.00	26.00	22.00
7	28.00	27.00	26.00	26.00	27.00	27.00	28.00	28.00	25.00	22.00
8	28.00	28.00	29.00	28.00	23.00	27.00	25.00	28.00	25.00	27.00
9	31.00	25.00	26.00	24.00	26.00	28.00	29.00	29.00	27.00	27.00
10	26.00	29.00	28.00	24.00	28.00	28.00	27.00	20.00	39.00	28.00
11	27.00	26.00	17.00	25.00	29.00	25.00	25.00	31.00	14.00	24.00
12	28.00	29.00	23.00	27.00	28.00	27.00	34.00	21.00	28.00	23.00
13	24.00	27.00	26.00	27.00	28.00	21.00	30.00	26.00	30.00	27.00
14	25.00	26.00	29.00	28.00	28.00	27.00	27.00	23.00	27.00	26.00
15	29.00	27.00	31.00	29.00	26.00	31.00	28.00	33.00	26.00	29.00
16	27.00	29.00	27.00	29.00	26.00	24.00	27.00	33.00	28.00	30.00
17	27.00	27.00	27.00	28.00	25.00	27.00	26.00	29.00	29.00	35.00
18	28.00	28.00	27.00	27.00	27.00	26.00	27.00	22.00	29.00	25.00
19	24.00	28.00	28.00	26.00	25.00	28.00	25.00	31.00	28.00	28.00
20	26.00	27.00	25.00	29.00	26.00	25.00	28.00	20.00	29.00	27.00

### HISTOGRAMA DE LO DATOS RECOLECTADOS





**CALCULO DEL RANGO "D"**

Se depuran un total de 10% de los datos siendo 5% por cada extremo del histograma

Lado izquierdo	
Valor a dividir (di) =	<b>3</b>
Existente (ei) =	<b>8</b>
Faltante (fi) =	<b>2</b>

Lado derecho	
Valor a dividir (dd) =	<b>6</b>
Existente (ed) =	<b>6</b>
Faltante (fd) =	<b>4</b>

N° de intervalos

Rango medio (dm) = **8**

Entonces "D" viene a ser:

$$D = \left( \frac{(d_i - f_i)}{d_i} + d_m + \frac{(d_a - f_a)}{d_a} \right) * 5 \text{ [mm]}$$

43.33                  mm

**CÁLCULO FACTOR DE CORRECCIÓN fc:**

Donde:

Ep = 6.2

Li = 25

Lf = 15

$$f_c = \left( \frac{(E_p * 10)}{(L_i - L_f) * 5} \right)$$

fc = 1.24 mm

**CÁLCULO DEL RANGO CORREGIDO Dc:**

$$D_c = D * f_c$$

Dc = 53.73 mm

**DETERMINACIÓN DEL I.R.I.:**

Para pavimentos nuevos:

I. R. I. = 0.0485 \* D<sub>c</sub>       $\implies$       (IRI < 2.4)

Para pavimentos en servicio:

I. R. I. = 0.593 + 0.0471 \* D<sub>c</sub>       $\implies$       (2.4 < IRI < 15.9)

**CÁLCULO DEL I.R.I.:**

Aplicando la fórmula para pavimentos en servicio:

I. R. I. = 0.593 + 0.0471 \* D<sub>c</sub>

**I.R.I.= 3.12 m/km**



**UNIVERSIDAD AUTÓNOMA JUAN MISAEL SARACHO**  
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**DPTO. DE TOPOGRAFIA Y VÍAS DE COMUNICACIÓN**  
**CARRERA DE INGENIERIA CIVIL**  
**LABORATORIO DE ASFALTOS**

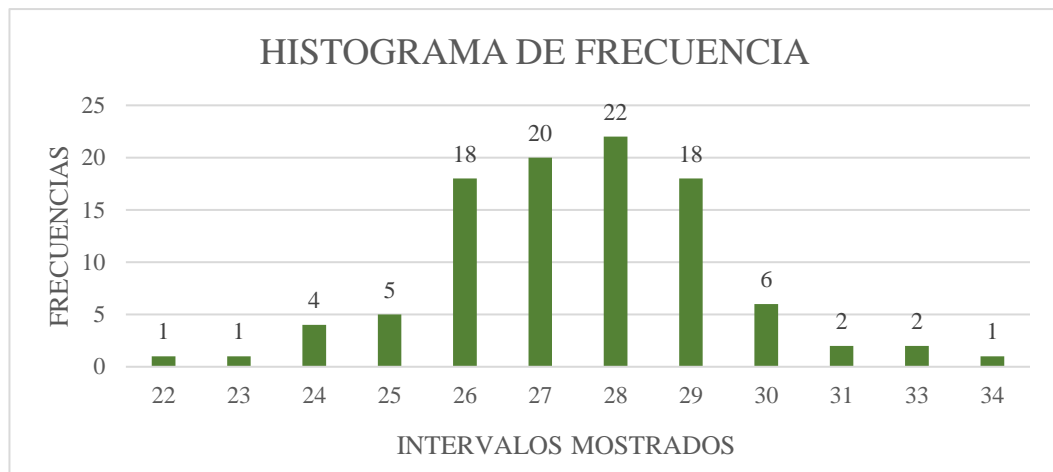
**Nombre del tramo:** Carretera San Mateo – Sella (Monte Méndez - Barrio El Taco)

**Carril de vuelta** Progresiva: 1+000 a 0+800

**Huella 2**

	1	2	3	4	5	6	7	8	9	10
1	26.00	24.00	22.00	22.00	24.00	29.00	22.00	26.00	28.00	26.00
2	23.00	23.00	22.00	25.00	26.00	30.00	28.00	27.00	24.00	25.00
3	21.00	22.00	27.00	24.00	25.00	26.00	27.00	28.00	30.00	31.00
4	24.00	23.00	21.00	22.00	26.00	30.00	28.00	29.00	26.00	26.00
5	20.00	15.00	23.00	23.00	23.00	26.00	25.00	28.00	25.00	26.00
6	21.00	20.00	21.00	22.00	23.00	27.00	28.00	27.00	27.00	28.00
7	23.00	24.00	24.00	26.00	26.00	29.00	29.00	27.00	29.00	27.00
8	22.00	22.00	25.00	23.00	25.00	28.00	33.00	28.00	26.00	26.00
9	21.00	25.00	21.00	27.00	24.00	28.00	31.00	29.00	28.00	26.00
10	24.00	24.00	21.00	23.00	26.00	29.00	28.00	28.00	29.00	30.00
11	21.00	25.00	27.00	25.00	23.00	34.00	29.00	27.00	27.00	30.00
12	24.00	22.00	22.00	26.00	25.00	27.00	29.00	23.00	26.00	26.00
13	20.00	22.00	24.00	23.00	24.00	33.00	27.00	26.00	26.00	27.00
14	26.00	21.00	23.00	26.00	24.00	27.00	29.00	29.00	28.00	25.00
15	25.00	22.00	25.00	24.00	23.00	30.00	26.00	28.00	27.00	27.00
16	24.00	24.00	24.00	24.00	22.00	29.00	28.00	29.00	25.00	24.00
17	23.00	23.00	25.00	23.00	24.00	29.00	24.00	27.00	29.00	28.00
18	22.00	27.00	24.00	25.00	26.00	28.00	29.00	28.00	27.00	27.00
19	25.00	23.00	22.00	26.00	27.00	26.00	28.00	27.00	28.00	28.00
20	22.00	24.00	22.00	29.00	23.00	29.00	26.00	26.00	27.00	24.00

**HISTOGRAMA DE LO DATOS RECOLECTADOS**





**CALCULO DEL RANGO "D"**

Se depuran un total de 10% de los datos siendo 5% por cada extremo del histograma

Lado izquierdo	
Valor a dividir (di) =	<b>5</b>
Existente (ei) =	<b>6</b>
Faltante (fi) =	<b>4</b>

Lado derecho	
Valor a dividir (dd) =	<b>6</b>
Existente (ed) =	<b>5</b>
Faltante (fd) =	<b>5</b>

N° de intervalos

Rango medio (dm) = **4**

Entonces "D" viene a ser:

$$D = \left( \frac{(d_i - f_i)}{d_i} + d_m + \frac{(d_d - f_d)}{d_d} \right) * 5 [mm]$$

D= 21.83 mm

**CÁLCULO FACTOR DE CORRECCIÓN fc:**

Donde:

- Ep = 6.2
- Li = 25
- Lf = 15

$$f_c = \left( \frac{(E_p * 10)}{(L_i - L_f) * 5} \right)$$

fc = 1.24 mm

**CÁLCULO DEL RANGO CORREGIDO Dc:**

$$D_c = D * f_c$$

Dc = 27.07 mm

**DETERMINACIÓN DEL I.R.I.:**

Para pavimentos nuevos:

I.R.I. = 0.0485 \* D<sub>c</sub>

→ (IRI < 2.4)

Para pavimentos en servicio:

I.R.I. = 0.593 + 0.0471 \* D<sub>c</sub>

→ (2.4 < IRI < 15.9)

**CÁLCULO DEL I.R.I.:**

Aplicando la fórmula para pavimentos en servicio:

I.R.I. = 0.593 + 0.0471 \* D<sub>c</sub>

I.R.I. = **1.87 m/km**





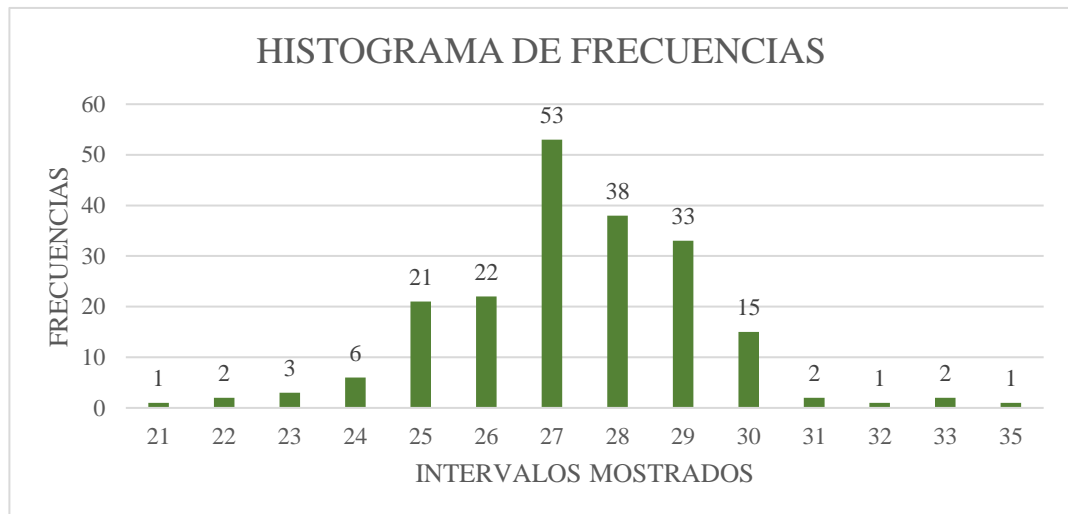
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**FACULTAD CIENCIAS Y TECNOLOGÍA**  
**DPTO. DE TOPOGRAFIA Y VÍAS DE COMUNICACIÓN**  
**CARRERA DE INGENIERIA CIVIL**  
**LABORATORIO DE ASFALTOS**

**Nombre del tramo:** Carretera San Mateo – Sella (Monte Méndez - Barrio El Taco)

**Carril de vuelta** Progresiva: 0+800 a 0+400

	1	2	3	4	5	6	7	8	9	10
1	28.00	27.00	29.00	28.00	26.00	27.00	29.00	27.00	25.00	28.00
2	29.00	25.00	28.00	30.00	28.00	28.00	23.00	28.00	28.00	30.00
3	26.00	30.00	29.00	26.00	27.00	22.00	27.00	27.00	27.00	28.00
4	27.00	25.00	23.00	28.00	29.00	26.00	26.00	28.00	29.00	26.00
5	27.00	28.00	25.00	27.00	25.00	30.00	29.00	29.00	30.00	27.00
6	28.00	27.00	23.00	29.00	27.00	26.00	29.00	28.00	29.00	27.00
7	29.00	27.00	28.00	30.00	31.00	27.00	25.00	27.00	28.00	25.00
8	28.00	22.00	29.00	27.00	30.00	26.00	24.00	30.00	26.00	27.00
9	27.00	25.00	28.00	29.00	25.00	27.00	25.00	28.00	28.00	25.00
10	25.00	27.00	29.00	28.00	29.00	29.00	21.00	33.00	29.00	33.00
11	29.00	25.00	27.00	29.00	27.00	24.00	28.00	24.00	30.00	27.00
12	27.00	27.00	27.00	28.00	26.00	29.00	27.00	28.00	29.00	27.00
13	27.00	24.00	30.00	27.00	25.00	27.00	25.00	25.00	27.00	26.00
14	30.00	30.00	27.00	25.00	28.00	26.00	31.00	28.00	29.00	28.00
15	25.00	24.00	26.00	25.00	27.00	25.00	27.00	28.00	27.00	29.00
16	27.00	27.00	26.00	27.00	27.00	29.00	29.00	30.00	29.00	32.00
17	29.00	28.00	28.00	29.00	29.00	28.00	27.00	28.00	26.00	29.00
18	27.00	27.00	28.00	28.00	24.00	26.00	26.00	27.00	29.00	28.00
19	26.00	27.00	27.00	35.00	27.00	29.00	30.00	27.00	30.00	27.00
20	25.00	26.00	26.00	27.00	27.00	28.00	26.00	28.00	26.00	28.00

**HISTOGRAMA DE LO DATOS RECOLECTADOS**





**CALCULO DEL RANGO "D"**

Se depuran un total de 10% de los datos siendo 5% por cada extremo del histograma

Lado izquierdo	
Valor a dividir (di) =	<b>6</b>
Existente (ei) =	6
Faltante (fi) =	<b>4</b>

Lado derecho	
Valor a dividir (dd) =	<b>15</b>
Existente (ed) =	6
Faltante (fd) =	<b>4</b>

N° de intervalos

Rango medio (dm) = **5**

Entonces "D" viene a ser:

$$D = \left( \frac{(d_i - f_i)}{d_i} + d_m + \frac{(d_d - f_d)}{d_d} \right) * 5 [mm]$$

D= 30.33 mm

**CÁLCULO FACTOR DE CORRECCIÓN fc:**

Donde:

- Ep = 6.2
- Li = 25
- Lf = 15

$$f_c = \left( \frac{(E_p * 10)}{(L_i - L_f) * 5} \right)$$

fc = 1.24 mm

**CÁLCULO DEL RANGO CORREGIDO Dc:**

$$D_c = D * f_c$$

Dc = 37.61 mm

**DETERMINACIÓN DEL I.R.I.:**

Para pavimentos nuevos:

$$I.R.I. = 0.0485 * D_c$$

⇒ (IRI < 2.4)

Para pavimentos en servicio:

$$I.R.I. = 0.593 + 0.0471 * D_c$$

⇒ (2.4 < IRI < 15.9)

**CÁLCULO DEL I.R.I.:**

Aplicando la fórmula para pavimentos en servicio:

$$I.R.I. = 0.593 + 0.0471 * D_c$$

I.R.I. = 2.36 m/km



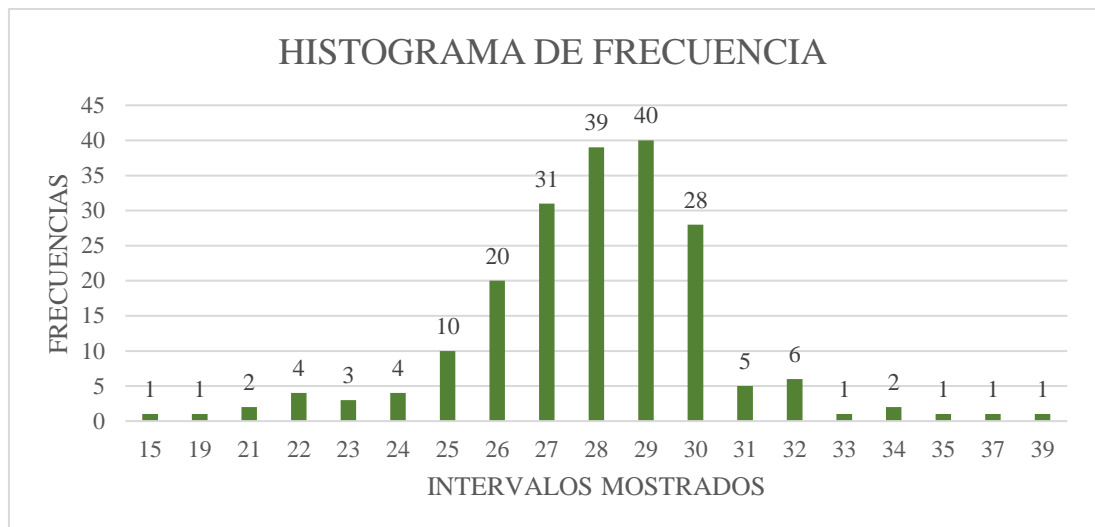
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 LABORATORIO DE ASFALTOS

**Nombre del tramo:** Carretera San Mateo – Sella (Monte Méndez - Barrio El Taco)

**Carril de vuelta** Progresiva: 0+400 a 0+000

	1	2	3	4	5	6	7	8	9	10
1	29.00	28.00	30.00	26.00	25.00	29.00	29.00	32.00	30.00	30.00
2	28.00	29.00	29.00	25.00	30.00	27.00	28.00	29.00	29.00	29.00
3	27.00	26.00	27.00	25.00	31.00	27.00	30.00	30.00	31.00	19.00
4	27.00	28.00	22.00	26.00	29.00	26.00	29.00	25.00	27.00	29.00
5	29.00	27.00	30.00	30.00	30.00	28.00	29.00	28.00	28.00	34.00
6	28.00	26.00	30.00	26.00	28.00	30.00	30.00	27.00	27.00	23.00
7	29.00	28.00	27.00	27.00	27.00	28.00	29.00	29.00	26.00	22.00
8	29.00	29.00	30.00	29.00	24.00	27.00	26.00	28.00	25.00	28.00
9	32.00	26.00	27.00	25.00	27.00	29.00	30.00	30.00	28.00	28.00
10	27.00	30.00	29.00	24.00	29.00	29.00	28.00	21.00	39.00	29.00
11	28.00	27.00	28.00	26.00	30.00	26.00	26.00	32.00	15.00	25.00
12	29.00	30.00	23.00	28.00	28.00	28.00	35.00	22.00	29.00	24.00
13	25.00	28.00	27.00	27.00	29.00	22.00	31.00	27.00	31.00	28.00
14	26.00	27.00	30.00	29.00	28.00	28.00	28.00	24.00	28.00	27.00
15	30.00	28.00	32.00	30.00	27.00	32.00	29.00	34.00	27.00	30.00
16	28.00	30.00	28.00	30.00	26.00	25.00	28.00	33.00	29.00	31.00
17	28.00	28.00	27.00	29.00	26.00	28.00	27.00	30.00	30.00	37.00
18	29.00	29.00	28.00	28.00	28.00	27.00	28.00	23.00	29.00	26.00
19	25.00	29.00	29.00	27.00	26.00	29.00	26.00	32.00	29.00	29.00
20	27.00	28.00	26.00	30.00	27.00	26.00	29.00	21.00	30.00	27.00

**HISTOGRAMA DE LO DATOS RECOLECTADOS**





**CALCULO DEL RANGO "D"**

Se depuran un total de 10% de los datos siendo 5% por cada extremo del histograma

<b>Lado izquierdo</b>	
Valor a dividir (di) =	<b>3</b>
Existente (ei) =	8
Faltante (fi) =	<b>2</b>

<b>Lado derecho</b>	
Valor a dividir (dd) =	<b>6</b>
Existente (ed) =	6
Faltante (fd) =	<b>4</b>

N° de intervalos

Rango medio (dm) = **8**

Entonces "D" viene a ser:

$$D = \left( \frac{(d_i - f_i)}{d_i} + d_m + \frac{(d_d - f_d)}{d_d} \right) * 5 [mm]$$

D = 43.33 mm

**CÁLCULO FACTOR DE CORRECCIÓN fc:**

Donde:

- Ep = 6.2
- Li = 25
- Lf = 15

$$f_c = \left( \frac{(E_p * 10)}{(L_i - L_f) * 5} \right)$$

fc = 1.24 mm

**CÁLCULO DEL RANGO CORREGIDO Dc:**

$$D_c = D * f_c$$

Dc = 53.73 mm

**DETERMINACIÓN DEL I.R.I.:**

Para pavimentos nuevos:

I. R. I. = 0.0485 \* D<sub>c</sub>

→ (IRI < 2.4)

Para pavimentos en servicio:

I. R. I. = 0.593 + 0.0471 \* D<sub>c</sub>

→ (2.4 < IRI < 15.9)

**CÁLCULO DEL I.R.I.:**

Aplicando la fórmula para pavimentos en servicio:

I. R. I. = 0.593 + 0.0471 \* D<sub>c</sub>

**I.R.I. = 3.12 m/km**



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FACULTAD CIENCIAS Y TECNOLOGÍA  
DPTO. DE TOPOGRAFIA Y VÍAS DE COMUNICACIÓN  
CARRERA DE INGENIERIA CIVIL  
LABORATORIO DE ASFALTOS

**Nombre del laboratorista/tesista:** Alejandra Ramos Quispe

**Fecha de realización del ensayo:** 25-09-2022

**Número de muestra:** 5

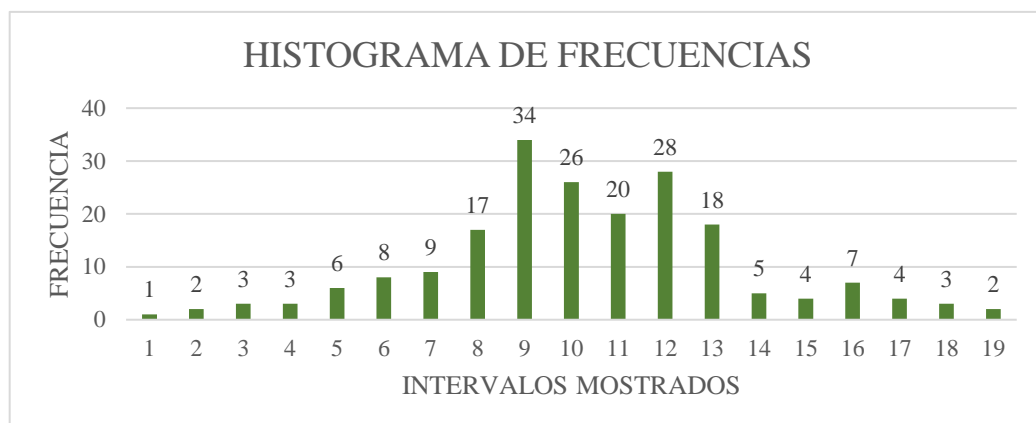
**Nombre del tramo:** Ruta Nacional 1 (Cruce Calamuchita – Entrada a Muturayo)

**Carril de ida** Progresiva: 0+000 a 0+400

### Huella 1

	1	2	3	4	5	6	7	8	9	10
1	26.00	25.00	27.00	27.00	23.00	26.00	23.00	27.00	23.00	30.00
2	25.00	23.00	29.00	21.00	26.00	27.00	25.00	26.00	22.00	31.00
3	26.00	25.00	23.00	21.00	22.00	18.00	24.00	30.00	23.00	29.00
4	26.00	23.00	26.00	21.00	19.00	23.00	25.00	22.00	24.00	28.00
5	24.00	22.00	22.00	23.00	25.00	20.00	24.00	30.00	30.00	25.00
6	24.00	21.00	24.00	25.00	23.00	23.00	24.00	21.00	30.00	28.00
7	22.00	26.00	27.00	24.00	27.00	20.00	22.00	24.00	31.00	28.00
8	27.00	25.00	23.00	26.00	26.00	20.00	30.00	21.00	25.00	34.00
9	32.00	26.00	26.00	25.00	24.00	21.00	27.00	23.00	24.00	23.00
10	24.00	27.00	25.00	23.00	26.00	19.00	22.00	24.00	23.00	10.00
11	27.00	28.00	23.00	23.00	27.00	24.00	22.00	26.00	24.00	16.00
12	24.00	26.00	23.00	24.00	30.00	24.00	23.00	26.00	23.00	19.00
13	22.00	24.00	27.00	23.00	32.00	22.00	24.00	23.00	23.00	20.00
14	23.00	26.00	24.00	26.00	23.00	22.00	25.00	24.00	23.00	25.00
15	18.00	24.00	25.00	24.00	25.00	22.00	22.00	25.00	20.00	23.00
16	15.00	23.00	26.00	26.00	26.00	25.00	22.00	25.00	19.00	26.00
17	26.00	26.00	27.00	27.00	21.00	31.00	25.00	23.00	28.00	16.00
18	27.00	27.00	23.00	24.00	21.00	31.00	27.00	26.00	29.00	19.00
19	23.00	26.00	22.00	23.00	18.00	27.00	20.00	24.00	34.00	20.00
20	26.00	26.00	29.00	23.00	16.00	19.00	15.00	20.00	32.00	22.00

### HISTOGRAMA DE LO DATOS RECOLECTADOS





**CALCULO DEL RANGO "D"**

Se depuran un total de 10% de los datos siendo 5% por cada extremo del histograma

<b>Lado izquierdo</b>	
Valor a dividir (di) =	<b>6</b>
Existente (ei) =	<b>9</b>
Faltante (fi) =	<b>1</b>

<b>Lado derecho</b>	
Valor a dividir (dd) =	<b>7</b>
Existente (ed) =	<b>9</b>
Faltante (fd) =	<b>1</b>

N° de intervalos

Rango medio (dm) = **10**

Entonces "D" viene a ser:

$$D = \left( \frac{(d_i - f_i)}{d_i} + d_m + \frac{(d_d - f_d)}{d_d} \right) * 5 [mm]$$

D= 58.42 mm

**CÁLCULO FACTOR DE CORRECCIÓN fc:**

Donde:

- Ep = 6.2
- Li = 25
- Lf = 15

$$f_c = \left( \frac{(E_p * 10)}{(L_i - L_f) * 5} \right)$$

fc = 1.24 mm

**CÁLCULO DEL RANGO CORREGIDO Dc:**

$$D_c = D * f_c$$

Dc = 72.48 mm

**DETERMINACIÓN DEL I.R.I.:**

Para pavimentos nuevos:

$$I. R. I. = 0.0485 * D_c$$

→ (IRI<2.4)

Para pavimentos en servicio:

$$I. R. I. = 0.593 + 0.0471 * D_c$$

→ (2.4<IRI<15.9)

**CÁLCULO DEL I.R.I.:**

Aplicando la fórmula para pavimentos en servicio:

$$I. R. I. = 0.593 + 0.0471 * D_c$$

**I.R.I.= 4.01 m/km**



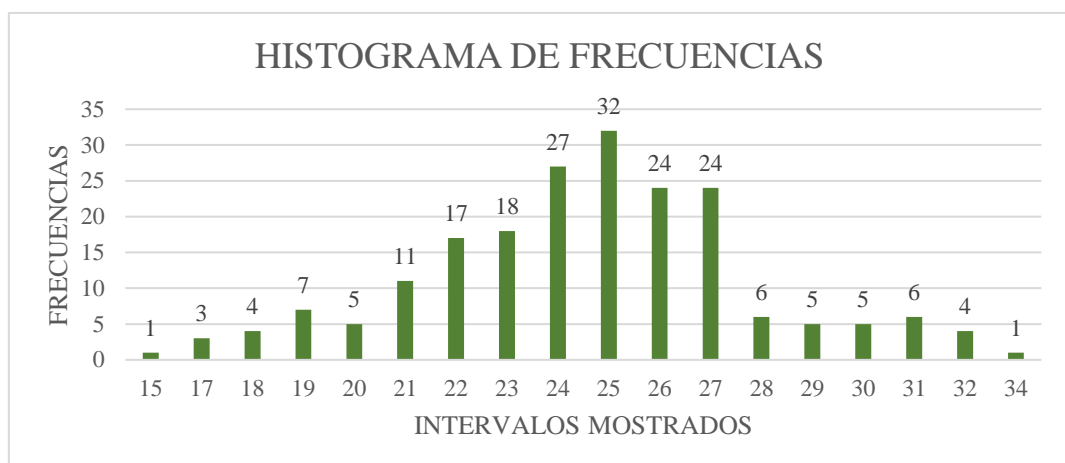
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 CARRERA DE INGENIERIA CIVIL  
 LABORATORIO DE ASFALTOS

**Nombre del tramo:** Ruta Nacional 1 (Cruce Calamuchita – Entrada a Maturayo)

**Carril de ida** Progresiva: 0+400 a 0+800

	1	2	3	4	5	6	7	8	9	10
1	31.00	19.00	22.00	19.00	24.00	25.00	26.00	25.00	25.00	25.00
2	27.00	17.00	27.00	25.00	25.00	22.00	25.00	25.00	25.00	28.00
3	22.00	24.00	29.00	24.00	20.00	26.00	23.00	24.00	24.00	22.00
4	22.00	26.00	21.00	31.00	24.00	27.00	23.00	22.00	19.00	27.00
5	26.00	25.00	26.00	23.00	26.00	23.00	24.00	22.00	21.00	23.00
6	29.00	26.00	25.00	27.00	29.00	21.00	26.00	25.00	30.00	25.00
7	25.00	24.00	26.00	26.00	24.00	25.00	24.00	24.00	21.00	23.00
8	23.00	23.00	25.00	27.00	28.00	22.00	24.00	24.00	26.00	25.00
9	19.00	27.00	27.00	22.00	20.00	26.00	21.00	24.00	21.00	24.00
10	27.00	24.00	27.00	27.00	26.00	24.00	32.00	23.00	27.00	26.00
11	20.00	21.00	24.00	25.00	24.00	26.00	32.00	23.00	26.00	23.00
12	27.00	22.00	24.00	22.00	23.00	28.00	23.00	28.00	25.00	24.00
13	25.00	26.00	27.00	29.00	21.00	23.00	21.00	28.00	25.00	31.00
14	27.00	22.00	26.00	26.00	27.00	24.00	24.00	21.00	22.00	30.00
15	22.00	26.00	25.00	25.00	27.00	26.00	24.00	21.00	25.00	32.00
16	27.00	26.00	18.00	19.00	24.00	23.00	18.00	26.00	22.00	15.00
17	28.00	23.00	23.00	17.00	27.00	27.00	24.00	25.00	26.00	18.00
18	25.00	25.00	29.00	22.00	25.00	30.00	22.00	23.00	31.00	20.00
19	19.00	24.00	27.00	27.00	18.00	27.00	27.00	34.00	31.00	30.00
20	17.00	25.00	19.00	25.00	20.00	25.00	25.00	32.00	31.00	30.00

**HISTOGRAMA DE LO DATOS RECOLECTADOS**





**CALCULO DEL RANGO "D"**

Se depuran un total de 10% de los datos siendo 5% por cada extremo del histograma

<b>Lado izquierdo</b>	
Valor a dividir (di) =	<b>7</b>
Existente (ei) =	<b>8</b>
Faltante (fi) =	<b>2</b>

<b>Lado derecho</b>	
Valor a dividir (dd) =	<b>6</b>
Existente (ed) =	<b>5</b>
Faltante (fd) =	<b>5</b>

N° de intervalos

Rango medio (dm) = **11**

Entonces "D" viene a ser:

$$D = \left( \frac{(d_i - f_i)}{d_i} + d_m + \frac{(d_d - f_d)}{d_d} \right) * 5 [mm]$$

D= 59.40 mm

**CÁLCULO FACTOR DE CORRECCIÓN fc:**

Donde:

Ep = 6.2  
 Li = 25  
 Lf = 15

$$f_c = \left( \frac{(E_p * 10)}{(L_i - L_f) * 5} \right)$$

fc = 1.24 mm

$$D_c = D * f_c$$

Dc = 73.66 mm

**CÁLCULO DEL RANGO CORREGIDO Dc:**

**DETERMINACIÓN DEL I.R.I.:**

Para pavimentos nuevos:

I. R. I. = 0.0485 \* D<sub>c</sub>

→ (IRI < 2.4)

Para pavimentos en servicio:

I. R. I. = 0.593 + 0.0471 \* D<sub>c</sub>

→ (2.4 < IRI < 15.9)

**CÁLCULO DEL I.R.I.:**

Aplicando la fórmula para pavimentos en servicio:

I. R. I. = 0.593 + 0.0471 \* D<sub>c</sub>

**I.R.I.= 4.06 m/km**





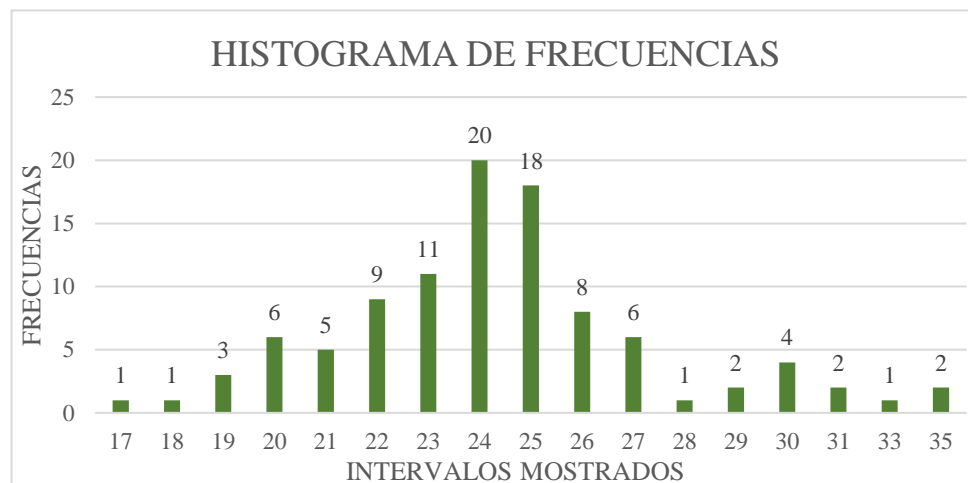
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 CARRERA DE INGENIERIA CIVIL  
 LABORATORIO DE ASFALTOS

**Nombre del tramo:** Ruta Nacional 1 (Cruce Calamuchita – Entrada a Muturayo)

**Carril de ida** Progresiva: 0+800 a 1+000

	1	2	3	4	5	6	7	8	9	10
1	24.00	17.00	31.00	24.00	20.00	23.00	22.00	30.00	25.00	26.00
2	24.00	25.00	23.00	22.00	24.00	26.00	27.00	24.00	25.00	22.00
3	25.00	23.00	25.00	22.00	29.00	23.00	25.00	20.00	26.00	23.00
4	23.00	21.00	22.00	24.00	26.00	25.00	27.00	24.00	26.00	21.00
5	19.00	21.00	22.00	26.00	23.00	26.00	26.00	23.00	26.00	30.00
6	25.00	27.00	21.00	24.00	24.00	23.00	28.00	29.00	25.00	24.00
7	23.00	24.00	26.00	27.00	25.00	28.00	26.00	27.00	24.00	31.00
8	25.00	25.00	23.00	24.00	27.00	23.00	22.00	28.00	26.00	34.00
9	24.00	25.00	21.00	25.00	27.00	27.00	25.00	23.00	21.00	19.00
10	23.00	25.00	25.00	24.00	25.00	26.00	24.00	27.00	15.00	23.00
11	24.00	22.00	28.00	22.00	22.00	26.00	23.00	24.00	26.00	27.00
12	23.00	22.00	25.00	23.00	26.00	25.00	25.00	28.00	25.00	22.00
13	24.00	27.00	30.00	24.00	20.00	28.00	25.00	21.00	28.00	25.00
14	19.00	20.00	24.00	24.00	25.00	23.00	26.00	28.00	30.00	24.00
15	18.00	20.00	23.00	25.00	25.00	26.00	26.00	23.00	32.00	30.00
16	20.00	24.00	23.00	26.00	25.00	28.00	29.00	24.00	25.00	21.00
17	20.00	30.00	24.00	25.00	22.00	26.00	30.00	30.00	25.00	19.00
18	19.00	29.00	35.00	27.00	24.00	25.00	26.00	27.00	17.00	20.00
19	24.00	30.00	33.00	35.00	21.00	31.00	24.00	27.00	26.00	20.00
20	26.00	31.00	30.00	26.00	26.00	31.00	21.00	29.00	27.00	20.00

**HISTOGRAMA DE LO DATOS RECOLECTADOS**





**CALCULO DEL RANGO "D"**

Se depuran un total de 10% de los datos siendo 5% por cada extremo del histograma

Lado izquierdo	
Valor a dividir (di) =	<b>6</b>
Existente (ei) =	<b>5</b>
Faltante (fi) =	<b>5</b>

Lado derecho	
Valor a dividir (dd) =	<b>2</b>
Existente (ed) =	<b>9</b>
Faltante (fd) =	<b>1</b>

N° de intervalos

Rango medio (dm) = **8**

Entonces "D" viene a ser:

$$D = \left( \frac{(d_i - f_i)}{d_i} + d_m + \frac{(d_d - f_d)}{d_d} \right) * 5 [mm]$$

D= 43.33 mm

**CÁLCULO FACTOR DE CORRECCIÓN fc:**

Donde:

Ep = 6.2  
 Li = 25  
 Lf = 15

$$f_c = \left( \frac{(E_p * 10)}{(L_i - L_f) * 5} \right)$$

fc = 1.24 mm

**CÁLCULO DEL RANGO CORREGIDO Dc:**

$$D_c = D * f_c$$

Dc = 53.73 mm

**DETERMINACIÓN DEL I.R.I.:**

Para pavimentos nuevos:

$$I. R. I. = 0.0485 * D_c$$

→ (IRI < 2.4)

Para pavimentos en servicio:

$$I. R. I. = 0.593 + 0.0471 * D_c$$

→ (2.4 < IRI < 15.9)

**CÁLCULO DEL I.R.I.:**

Aplicando la fórmula para pavimentos en servicio:

$$I. R. I. = 0.593 + 0.0471 * D_c$$

**I.R.I.= 3.12 m/km**



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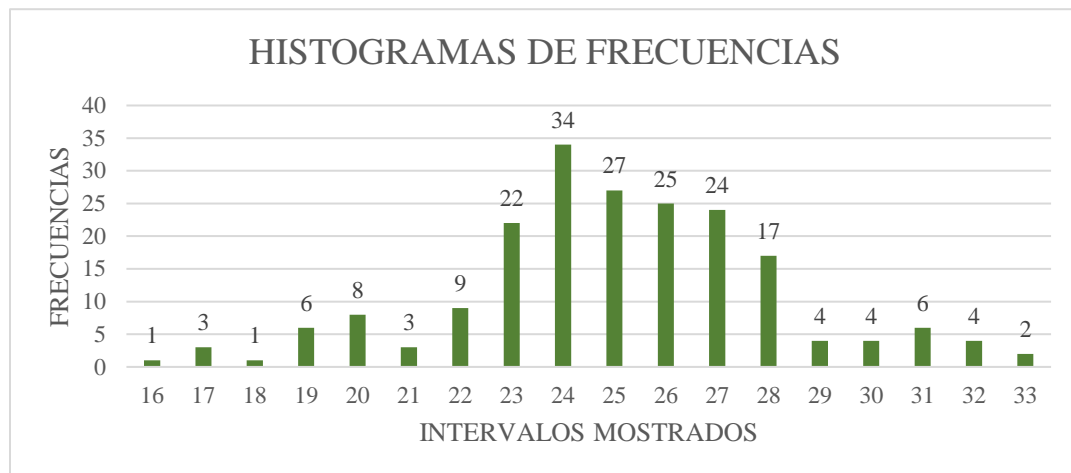
**Nombre del tramo:** Ruta Nacional 1 (Cruce Calamuchita – Entrada a Muturayo)

**Carril de ida** Progresiva: 0+000 a 0+400

**Huella 2**

	1	2	3	4	5	6	7	8	9	10
1	27.00	26.00	28.00	27.00	24.00	27.00	23.00	28.00	24.00	31.00
2	25.00	24.00	29.00	22.00	27.00	28.00	26.00	27.00	23.00	32.00
3	27.00	26.00	24.00	19.00	23.00	19.00	25.00	30.00	24.00	30.00
4	26.00	24.00	27.00	21.00	20.00	23.00	26.00	23.00	25.00	28.00
5	25.00	22.00	23.00	24.00	25.00	21.00	25.00	31.00	24.00	26.00
6	24.00	22.00	25.00	26.00	24.00	24.00	24.00	22.00	31.00	29.00
7	23.00	27.00	28.00	25.00	28.00	20.00	23.00	25.00	32.00	28.00
8	28.00	26.00	23.00	27.00	27.00	17.00	31.00	22.00	26.00	25.00
9	32.00	27.00	27.00	26.00	25.00	22.00	28.00	24.00	25.00	24.00
10	25.00	28.00	26.00	23.00	27.00	24.00	23.00	25.00	23.00	23.00
11	28.00	29.00	24.00	24.00	27.00	25.00	22.00	27.00	25.00	17.00
12	24.00	26.00	23.00	25.00	29.00	24.00	24.00	26.00	24.00	20.00
13	23.00	25.00	28.00	24.00	32.00	23.00	25.00	24.00	23.00	21.00
14	24.00	27.00	24.00	26.00	24.00	23.00	26.00	25.00	24.00	26.00
15	25.00	25.00	26.00	25.00	26.00	22.00	23.00	18.00	23.00	24.00
16	26.00	24.00	27.00	27.00	27.00	26.00	22.00	26.00	20.00	26.00
17	27.00	26.00	28.00	28.00	19.00	31.00	16.00	24.00	30.00	25.00
18	28.00	28.00	24.00	24.00	20.00	25.00	19.00	26.00	30.00	20.00
19	25.00	27.00	19.00	23.00	24.00	28.00	20.00	25.00	33.00	17.00
20	33.00	26.00	31.00	19.00	27.00	24.00	20.00	27.00	27.00	23.00

**HISTOGRAMA DE LO DATOS RECOLECTADOS**





**CALCULO DEL RANGO "D"**

Se depuran un total de 10% de los datos siendo 5% por cada extremo del histograma

Lado izquierdo	
Valor a dividir (di) =	6
Existente (ei) =	5
Faltante (fi) =	5

Lado derecho	
Valor a dividir (dd) =	6
Existente (ed) =	6
Faltante (fd) =	4

N° de intervalos

Rango medio (dm) = 11

Entonces "D" viene a ser:

$$D = \left( \frac{(d_i - f_i)}{d_i} + d_m + \frac{(d_a - f_a)}{d_a} \right) * 5 [mm]$$

D= 57.5 mm

**CÁLCULO FACTOR DE CORRECCIÓN fc:**

Donde:

Ep = 6.2  
 Li = 25  
 Lf = 15

$$f_c = \left( \frac{(E_p * 10)}{(L_i - L_f) * 5} \right)$$

fc = 1.24 mm

**CÁLCULO DEL RANGO CORREGIDO Dc:**

$$D_c = D * f_c$$

Dc = 71.3 mm

**DETERMINACIÓN DEL I.R.I.:**

Para pavimentos nuevos:

$$I. R. I. = 0.0485 * D_c$$

(IRI < 2.4)

Para pavimentos en servicio:

$$I. R. I. = 0.593 + 0.0471 * D_c$$

(2.4 < IRI < 15.9)

**CÁLCULO DEL I.R.I.:**

Aplicando la fórmula para pavimentos en servicio:

$$I. R. I. = 0.593 + 0.0471 * D_c$$

I.R.I.= 3.95 m/km



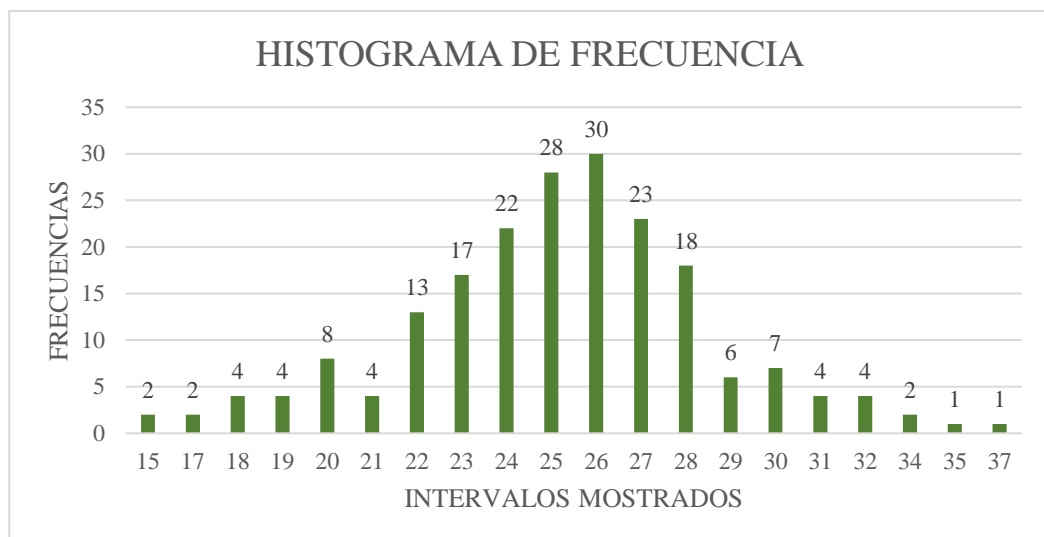
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 LABORATORIO DE ASFALTOS

**Nombre del tramo:** Ruta Nacional 1 (Cruce Calamuchita – Entrada a Muturayo)

**Carril de ida** Progresiva: 0+400 a 0+800

	1	2	3	4	5	6	7	8	9	10
1	31.00	20.00	23.00	20.00	25.00	20.00	27.00	26.00	25.00	26.00
2	28.00	26.00	28.00	26.00	26.00	23.00	26.00	25.00	26.00	21.00
3	23.00	25.00	29.00	25.00	21.00	27.00	24.00	25.00	25.00	23.00
4	22.00	26.00	22.00	31.00	24.00	28.00	23.00	23.00	28.00	27.00
5	27.00	26.00	27.00	24.00	27.00	24.00	25.00	22.00	22.00	24.00
6	30.00	27.00	26.00	28.00	29.00	22.00	27.00	26.00	30.00	26.00
7	26.00	25.00	27.00	27.00	25.00	25.00	25.00	25.00	22.00	24.00
8	20.00	24.00	26.00	28.00	29.00	23.00	24.00	25.00	27.00	26.00
9	20.00	27.00	27.00	23.00	21.00	27.00	22.00	24.00	22.00	25.00
10	18.00	25.00	28.00	27.00	27.00	25.00	25.00	24.00	28.00	26.00
11	15.00	22.00	25.00	26.00	25.00	26.00	24.00	23.00	27.00	24.00
12	28.00	20.00	24.00	23.00	24.00	29.00	24.00	35.00	26.00	25.00
13	26.00	26.00	28.00	29.00	22.00	24.00	22.00	28.00	25.00	26.00
14	27.00	23.00	27.00	32.00	28.00	25.00	25.00	37.00	23.00	23.00
15	19.00	27.00	26.00	26.00	28.00	19.00	24.00	22.00	26.00	28.00
16	15.00	26.00	25.00	25.00	25.00	24.00	22.00	27.00	23.00	27.00
17	29.00	24.00	24.00	23.00	20.00	27.00	19.00	26.00	32.00	28.00
18	26.00	26.00	30.00	23.00	20.00	17.00	17.00	24.00	32.00	21.00
19	18.00	25.00	28.00	28.00	18.00	28.00	30.00	30.00	34.00	30.00
20	18.00	19.00	23.00	34.00	24.00	26.00	30.00	32.00	31.00	31.00

**HISTOGRAMA DE LO DATOS RECOLECTADOS**





**CALCULO DEL RANGO "D"**

Se depuran un total de 10% de los datos siendo 5% por cada extremo del histograma

<b>Lado izquierdo</b>	
Valor a dividir (di) =	<b>4</b>
Existente (ei) =	8
Faltante (fi) =	<b>2</b>

<b>Lado derecho</b>	
Valor a dividir (dd) =	<b>4</b>
Existente (ed) =	8
Faltante (fd) =	<b>2</b>

N° de intervalos

Rango medio (dm) = **11**

Entonces "D" viene a ser:

$$D = \left( \frac{(d_i - f_i)}{d_i} + d_m + \frac{(d_d - f_d)}{d_d} \right) * 5 [mm]$$

D= 60 mm

**CÁLCULO FACTOR DE CORRECCIÓN fc:**

Donde:

Ep = 6.2  
 Li = 25  
 Lf = 15

$$f_c = \left( \frac{(E_p * 10)}{(L_i - L_f) * 5} \right)$$

fc = 1.24 mm

**CÁLCULO DEL RANGO CORREGIDO Dc:**

$$D_c = D * f_c$$

Dc = 74.4 mm

**DETERMINACIÓN DEL I.R.I.:**

Para pavimentos nuevos:

$$I.R.I. = 0.0485 * D_c$$

→ (IRI<2.4)

Para pavimentos en servicio:

$$I.R.I. = 0.593 + 0.0471 * D_c$$

→ (2.4<IRI<15.9)

**CÁLCULO DEL I.R.I.:**

Aplicando la fórmula para pavimentos en servicio:

$$I.R.I. = 0.593 + 0.0471 * D_c$$

I.R.I.= **4.10 m/km**



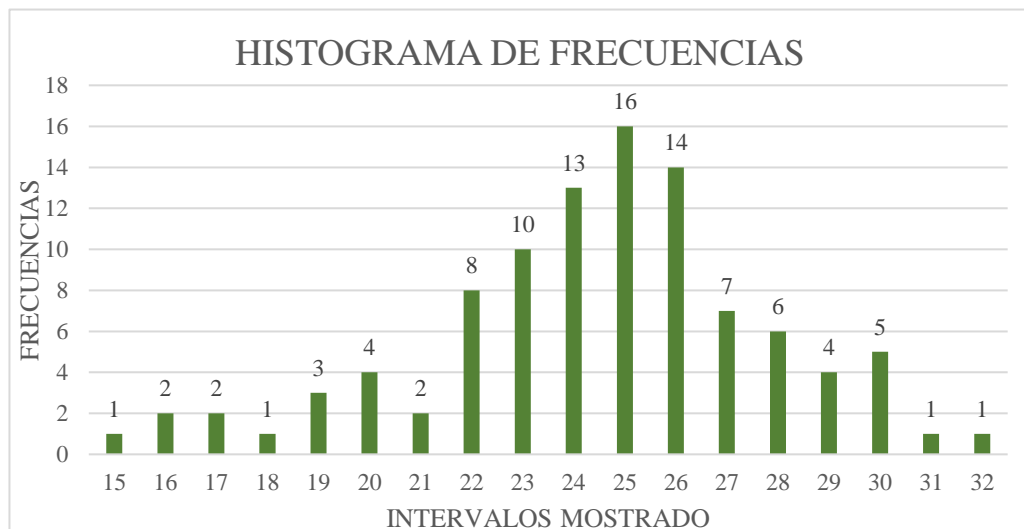
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**FACULTAD CIENCIAS Y TECNOLOGÍA**  
**DPTO. DE TOPOGRAFIA Y VÍAS DE COMUNICACIÓN**  
**CARRERA DE INGENIERIA CIVIL**  
**LABORATORIO DE ASFALTOS**

**Nombre del tramo:** Ruta Nacional 1 (Cruce Calamuchita – Entrada a Muturayo)

**Carril de ida** Progresiva: 0+800 a 1+000

	1	2	3	4	5	6	7	8	9	10
1	25.00	23.00	22.00	25.00	21.00	24.00	23.00	30.00	19.00	27.00
2	24.00	25.00	24.00	23.00	32.00	27.00	27.00	25.00	20.00	23.00
3	26.00	24.00	26.00	22.00	29.00	24.00	26.00	27.00	19.00	24.00
4	24.00	22.00	23.00	25.00	27.00	25.00	28.00	25.00	27.00	22.00
5	20.00	22.00	22.00	27.00	24.00	27.00	27.00	24.00	26.00	30.00
6	15.00	27.00	22.00	25.00	25.00	24.00	28.00	29.00	26.00	20.00
7	24.00	25.00	27.00	29.00	26.00	28.00	27.00	28.00	25.00	20.00
8	26.00	26.00	24.00	30.00	28.00	24.00	23.00	29.00	27.00	34.00
9	25.00	26.00	25.00	26.00	27.00	28.00	26.00	24.00	22.00	20.00
10	24.00	18.00	26.00	25.00	26.00	26.00	25.00	28.00	19.00	24.00
11	25.00	23.00	29.00	16.00	23.00	27.00	24.00	25.00	26.00	28.00
12	24.00	23.00	26.00	16.00	27.00	26.00	26.00	28.00	26.00	23.00
13	25.00	28.00	28.00	24.00	24.00	29.00	25.00	22.00	29.00	17.00
14	20.00	23.00	19.00	25.00	26.00	24.00	27.00	29.00	31.00	19.00
15	20.00	22.00	24.00	26.00	25.00	27.00	26.00	22.00	24.00	27.00
16	19.00	17.00	23.00	27.00	26.00	29.00	30.00	25.00	26.00	21.00
17	19.00	24.00	25.00	30.00	23.00	32.00	31.00	27.00	25.00	21.00
18	28.00	26.00	31.00	30.00	25.00	26.00	27.00	28.00	26.00	15.00
19	21.00	28.00	30.00	29.00	22.00	24.00	25.00	27.00	32.00	20.00
20	17.00	23.00	28.00	30.00	20.00	26.00	25.00	26.00	32.00	20.00

**HISTOGRAMA DE LO DATOS RECOLECTADOS**





**CALCULO DEL RANGO "D"**

Se depuran un total de 10% de los datos siendo 5% por cada extremo del histograma

<b>Lado izquierdo</b>	
Valor a dividir (di) =	<b>4</b>
Existente (ei) =	9
Faltante (fi) =	<b>1</b>

<b>Lado derecho</b>	
Valor a dividir (dd) =	<b>4</b>
Existente (ed) =	7
Faltante (fd) =	<b>3</b>

N° de intervalos

Rango medio (dm) = **8**

Entonces "D" viene a ser:

$$D = \left( \frac{(d_i - f_i)}{d_i} + d_m + \frac{(d_d - f_d)}{d_d} \right) * 5 [mm]$$

D= 45 mm

**CÁLCULO FACTOR DE CORRECCIÓN fc:**

Donde:

- Ep = 6.2
- Li = 25
- Lf = 15

$$f_c = \left( \frac{(E_p * 10)}{(L_i - L_f) * 5} \right)$$

fc = 1.24 mm

**CÁLCULO DEL RANGO CORREGIDO Dc:**

$$D_c = D * f_c$$

Dc = 55.8 mm

**DETERMINACIÓN DEL I.R.I.:**

Para pavimentos nuevos:

I. R. I. =  $0.0485 * D_c$   $\implies$  (IRI<2.4)

Para pavimentos en servicio:

I. R. I. =  $0.593 + 0.0471 * D_c$   $\implies$  (2.4<IRI<15.9)

**CÁLCULO DEL I.R.I.:**

Aplicando la fórmula para pavimentos en servicio:

I. R. I. =  $0.593 + 0.0471 * D_c$

**I.R.I.= 3.22 m/km**





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**CARRERA DE INGENIERIA CIVIL**  
**LABORATORIO DE ASFALTOS**

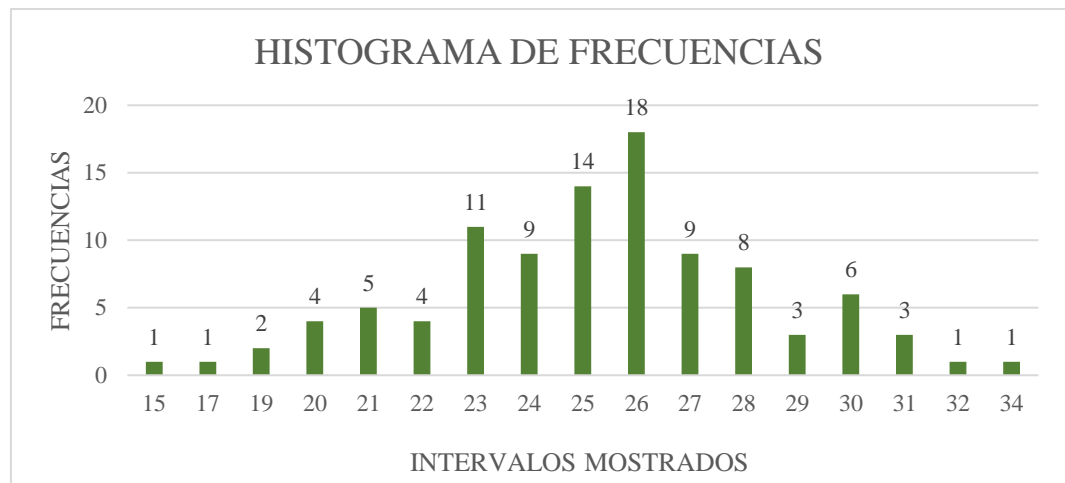
**Nombre del tramo:** Ruta Nacional 1 (Cruce Calamuchita – Entrada a Muturayo)

**Carril de vuelta** Progresiva: 1+000 a 0+800

**Huella 1**

	1	2	3	4	5	6	7	8	9	10
1	24.00	17.00	31.00	24.00	20.00	23.00	22.00	30.00	25.00	26.00
2	24.00	25.00	23.00	22.00	24.00	26.00	27.00	24.00	25.00	22.00
3	25.00	23.00	25.00	22.00	29.00	23.00	25.00	20.00	26.00	23.00
4	23.00	21.00	22.00	24.00	26.00	25.00	27.00	24.00	26.00	21.00
5	19.00	21.00	22.00	26.00	23.00	26.00	26.00	23.00	26.00	30.00
6	25.00	27.00	21.00	24.00	24.00	23.00	28.00	29.00	25.00	24.00
7	23.00	24.00	26.00	27.00	25.00	28.00	26.00	27.00	24.00	31.00
8	25.00	25.00	23.00	24.00	27.00	23.00	22.00	28.00	26.00	34.00
9	24.00	25.00	21.00	25.00	27.00	27.00	25.00	23.00	21.00	19.00
10	23.00	25.00	25.00	24.00	25.00	26.00	24.00	27.00	15.00	23.00
11	24.00	22.00	28.00	22.00	22.00	26.00	23.00	24.00	26.00	27.00
12	23.00	22.00	25.00	23.00	26.00	25.00	25.00	28.00	25.00	22.00
13	24.00	27.00	30.00	24.00	20.00	28.00	25.00	21.00	28.00	25.00
14	19.00	20.00	24.00	24.00	25.00	23.00	26.00	28.00	30.00	24.00
15	18.00	20.00	23.00	25.00	25.00	26.00	26.00	23.00	32.00	30.00
16	20.00	24.00	23.00	26.00	25.00	28.00	29.00	24.00	25.00	21.00
17	20.00	30.00	24.00	25.00	22.00	26.00	30.00	30.00	25.00	19.00
18	19.00	29.00	35.00	27.00	24.00	25.00	26.00	27.00	17.00	20.00
19	24.00	30.00	33.00	35.00	21.00	31.00	24.00	27.00	26.00	20.00
20	26.00	31.00	30.00	26.00	26.00	31.00	21.00	29.00	27.00	20.00

**HISTOGRAMA DE LO DATOS RECOLECTADOS**





**CALCULO DEL RANGO "D"**

Se depuran un total de 10% de los datos siendo 5% por cada extremo del histograma

<b>Lado izquierdo</b>	
Valor a dividir (di) =	<b>5</b>
Existente (ei) =	<b>8</b>
Faltante (fi) =	<b>2</b>

<b>Lado derecho</b>	
Valor a dividir (dd) =	<b>6</b>
Existente (ed) =	<b>5</b>
Faltante (fd) =	<b>5</b>

N° de intervalos

Rango medio (dm) = **8**

Entonces "D" viene a ser:

$$D = \left( \frac{(d_i - f_i)}{d_i} + d_m + \frac{(d_d - f_d)}{d_d} \right) * 5 [mm]$$

D= 43.83 mm

**CÁLCULO FACTOR DE CORRECCIÓN fc:**

Donde:

- Ep = 6.2
- Li = 25
- Lf = 15

$$f_c = \left( \frac{(E_p * 10)}{(L_i - L_f) * 5} \right)$$

fc = 1.24 mm

**CÁLCULO DEL RANGO CORREGIDO Dc:**

$$D_c = D * f_c$$

Dc = 54.35 mm

**DETERMINACIÓN DEL I.R.I.:**

Para pavimentos nuevos:

I. R. I. = 0.0485 \* D<sub>c</sub>

→ (IRI < 2.4)

Para pavimentos en servicio:

I. R. I. = 0.593 + 0.0471 \* D<sub>c</sub>

→ (2.4 < IRI < 15.9)

**CÁLCULO DEL I.R.I.:**

Aplicando la fórmula para pavimentos en servicio:

I. R. I. = 0.593 + 0.0471 \* D<sub>c</sub>

**I.R.I. = 3.15 m/km**



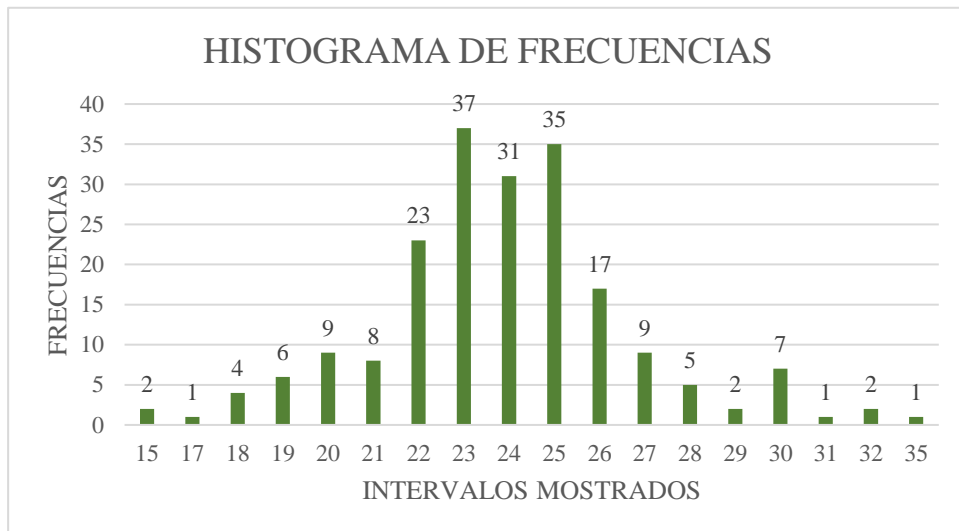
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**CARRERA DE INGENIERIA CIVIL**  
**LABORATORIO DE ASFALTOS**

**Nombre del tramo:** Ruta Nacional 1 (Cruce Calamuchita – Entrada a Muturayo)

**Carril de ida** Progresiva: 0+800 a 0+400

	1	2	3	4	5	6	7	8	9	10
1	23.00	27.00	25.00	24.00	25.00	26.00	23.00	23.00	28.00	24.00
2	25.00	20.00	23.00	23.00	21.00	26.00	26.00	22.00	26.00	23.00
3	23.00	35.00	23.00	25.00	22.00	26.00	25.00	20.00	23.00	22.00
4	23.00	25.00	24.00	29.00	23.00	25.00	22.00	23.00	22.00	28.00
5	25.00	24.00	24.00	25.00	23.00	22.00	21.00	22.00	26.00	25.00
6	24.00	26.00	26.00	25.00	24.00	24.00	27.00	27.00	24.00	25.00
7	27.00	24.00	25.00	23.00	25.00	25.00	23.00	25.00	23.00	23.00
8	22.00	25.00	25.00	23.00	20.00	23.00	20.00	24.00	25.00	23.00
9	27.00	25.00	24.00	20.00	26.00	23.00	19.00	25.00	24.00	22.00
10	27.00	24.00	24.00	22.00	25.00	23.00	21.00	24.00	21.00	25.00
11	23.00	25.00	26.00	20.00	25.00	20.00	22.00	24.00	23.00	25.00
12	29.00	23.00	24.00	28.00	24.00	30.00	25.00	24.00	21.00	23.00
13	22.00	23.00	25.00	30.00	25.00	30.00	23.00	18.00	26.00	21.00
14	22.00	23.00	27.00	26.00	24.00	30.00	26.00	18.00	21.00	23.00
15	23.00	24.00	24.00	25.00	19.00	22.00	27.00	25.00	25.00	28.00
16	24.00	24.00	26.00	23.00	20.00	20.00	30.00	22.00	27.00	32.00
17	22.00	24.00	25.00	24.00	24.00	15.00	30.00	23.00	18.00	32.00
18	22.00	22.00	25.00	26.00	22.00	24.00	21.00	18.00	23.00	23.00
19	22.00	17.00	24.00	26.00	19.00	25.00	15.00	22.00	30.00	23.00
20	19.00	24.00	26.00	23.00	19.00	28.00	19.00	22.00	31.00	22.00

**HISTOGRAMA DE LO DATOS RECOLECTADOS**





**CALCULO DEL RANGO "D"**

Se depuran un total de 10% de los datos siendo 5% por cada extremo del histograma

Lado izquierdo	
Valor a dividir (di) =	<b>6</b>
Existente (ei) =	7
Faltante (fi) =	<b>3</b>

Lado derecho	
Valor a dividir (dd) =	<b>7</b>
Existente (ed) =	4
Faltante (fd) =	<b>6</b>

N° de intervalos

Rango medio (dm) = **10**

Entonces "D" viene a ser:

$$D = \left( \frac{(d_i - f_i)}{d_i} + d_m + \frac{(d_d - f_d)}{d_d} \right) * 5 [mm]$$

D= 53.21 mm

**CÁLCULO FACTOR DE CORRECCIÓN fc:**

Donde:

Ep = 6.2  
 Li = 25  
 Lf = 15

$$f_c = \left( \frac{(E_p * 10)}{(L_i - L_f) * 5} \right)$$

fc = 1.24 mm

**CÁLCULO DEL RANGO CORREGIDO Dc:**

$$D_c = D * f_c$$

Dc = 65.98 mm

**DETERMINACIÓN DEL I.R.I.:**

Para pavimentos nuevos:

$$I.R.I. = 0.0485 * D_c$$

→ (IRI < 2.4)

Para pavimentos en servicio:

$$I.R.I. = 0.593 + 0.0471 * D_c$$

→ (2.4 < IRI < 15.9)

**CÁLCULO DEL I.R.I.:**

Aplicando la fórmula para pavimentos en servicio:

$$I.R.I. = 0.593 + 0.0471 * D_c$$

I.R.I. = **3.70 m/km**



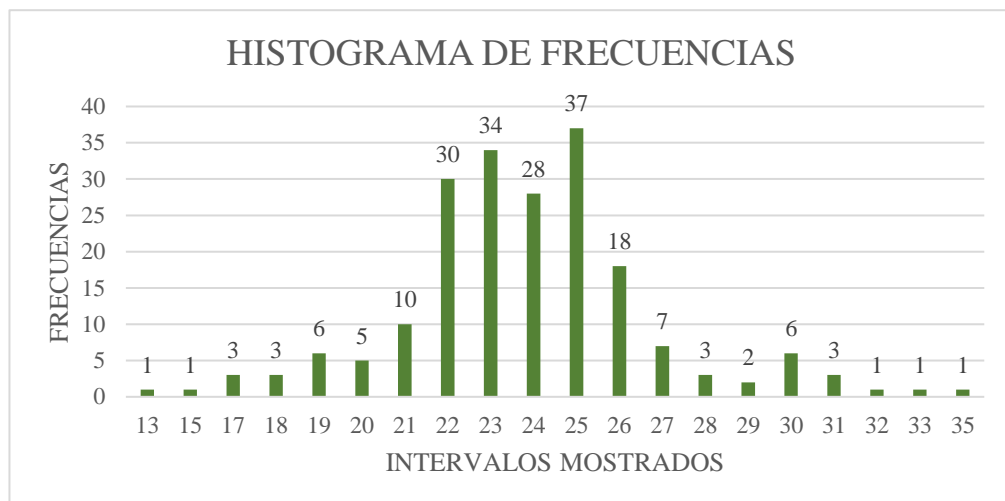
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 CARRERA DE INGENIERIA CIVIL  
 LABORATORIO DE ASFALTOS

Nombre del tramo: Ruta Nacional 1 (Cruce Calamuchita – Entrada a Muturayo)

Carril de vuelta Progresiva: 0+400 a 0+000

	1	2	3	4	5	6	7	8	9	10
1	22.00	23.00	25.00	18.00	25.00	21.00	26.00	24.00	22.00	23.00
2	22.00	22.00	26.00	26.00	25.00	22.00	22.00	26.00	26.00	25.00
3	30.00	22.00	17.00	26.00	24.00	23.00	25.00	24.00	25.00	25.00
4	23.00	13.00	21.00	21.00	25.00	23.00	22.00	24.00	23.00	24.00
5	21.00	24.00	21.00	18.00	25.00	22.00	25.00	25.00	20.00	23.00
6	23.00	25.00	25.00	23.00	23.00	27.00	21.00	23.00	23.00	24.00
7	24.00	24.00	23.00	22.00	25.00	23.00	23.00	26.00	24.00	22.00
8	24.00	24.00	24.00	22.00	25.00	22.00	25.00	23.00	35.00	32.00
9	22.00	24.00	28.00	21.00	25.00	22.00	23.00	25.00	25.00	23.00
10	22.00	28.00	22.00	22.00	21.00	25.00	19.00	23.00	25.00	22.00
11	26.00	26.00	24.00	25.00	27.00	25.00	25.00	20.00	20.00	25.00
12	15.00	24.00	26.00	22.00	22.00	22.00	23.00	27.00	19.00	24.00
13	19.00	19.00	26.00	23.00	20.00	23.00	28.00	21.00	26.00	27.00
14	26.00	30.00	25.00	23.00	31.00	24.00	30.00	21.00	27.00	23.00
15	26.00	24.00	23.00	22.00	25.00	23.00	18.00	22.00	26.00	31.00
16	25.00	25.00	23.00	17.00	27.00	33.00	25.00	26.00	20.00	31.00
17	24.00	22.00	25.00	25.00	23.00	25.00	22.00	23.00	24.00	24.00
18	25.00	22.00	23.00	27.00	17.00	29.00	29.00	19.00	23.00	24.00
19	25.00	24.00	26.00	23.00	24.00	30.00	24.00	24.00	24.00	30.00
20	22.00	22.00	22.00	25.00	25.00	30.00	26.00	23.00	19.00	23.00

HISTOGRAMA DE LO DATOS RECOLECTADOS





**CALCULO DEL RANGO "D"**

Se depuran un total de 10% de los datos siendo 5% por cada extremo del histograma

Lado izquierdo	
Valor a dividir (di) =	<b>6</b>
Existente (ei) =	8
Faltante (fi) =	<b>2</b>

Lado derecho	
Valor a dividir (dd) =	<b>6</b>
Existente (ed) =	6
Faltante (fd) =	<b>4</b>

N° de intervalos

Rango medio (dm) = **10**

Entonces "D" viene a ser:

$$D = \left( \frac{(d_i - f_i)}{d_i} + d_m + \frac{(d_d - f_d)}{d_d} \right) * 5 [mm]$$

D= 55      mm

**CÁLCULO FACTOR DE CORRECCIÓN fc:**

Donde:

- Ep = 6.2
- Li = 25
- Lf = 15

$$f_c = \left( \frac{(E_p * 10)}{(L_i - L_f) * 5} \right)$$

fc = 1.24 mm

**CÁLCULO DEL RANGO CORREGIDO Dc:**

$$D_c = D * f_c$$

Dc = 68.2 mm

**DETERMINACIÓN DEL I.R.I.:**

Para pavimentos nuevos:

I. R. I. = 0.0485 \* Dc      ⇒      (IRI<2.4)

Para pavimentos en servicio:

I. R. I. = 0.593 + 0.0471 \* Dc      ⇒      (2.4<IRI<15.9)

**CÁLCULO DEL I.R.I.:**

Aplicando la fórmula para pavimentos en servicio:

I. R. I. = 0.593 + 0.0471 \* Dc

**I.R.I.= 3.81 m/km**



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**CARRERA DE INGENIERIA CIVIL**  
**LABORATORIO DE ASFALTOS**

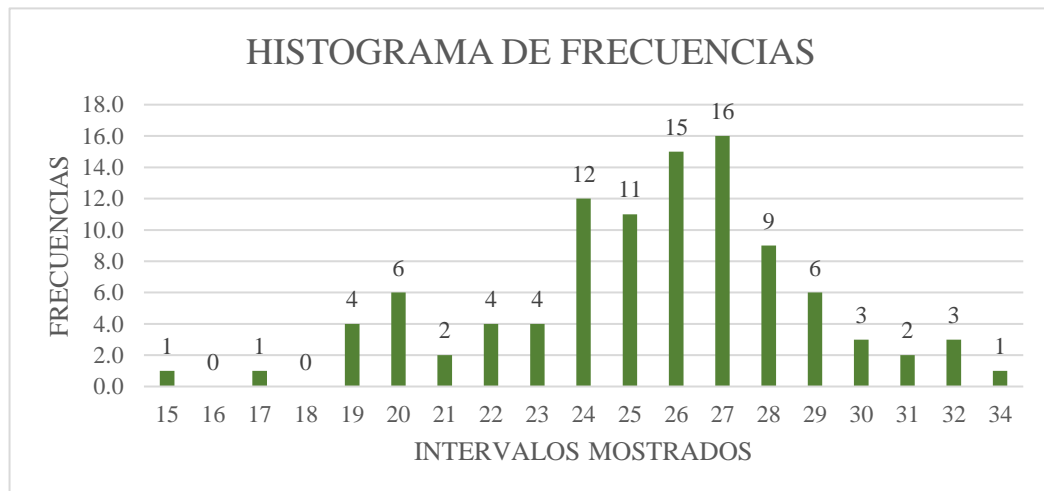
**Nombre del tramo:** Ruta Nacional 1 (Cruce Calamuchita – Entrada a Muturayo)

**Carril de vuelta** Progresiva: 1+000 a 0+800

**Huella 2**

	1	2	3	4	5	6	7	8	9	10
1	25.00	23.00	22.00	25.00	21.00	24.00	23.00	30.00	19.00	27.00
2	24.00	25.00	24.00	23.00	32.00	27.00	27.00	25.00	20.00	23.00
3	26.00	24.00	26.00	22.00	29.00	24.00	26.00	27.00	19.00	24.00
4	24.00	22.00	23.00	25.00	27.00	25.00	28.00	25.00	27.00	22.00
5	20.00	22.00	22.00	27.00	24.00	27.00	27.00	24.00	26.00	30.00
6	15.00	27.00	22.00	25.00	25.00	24.00	28.00	29.00	26.00	20.00
7	24.00	25.00	27.00	29.00	26.00	28.00	27.00	28.00	25.00	20.00
8	26.00	26.00	24.00	30.00	28.00	24.00	23.00	29.00	27.00	34.00
9	25.00	26.00	25.00	26.00	27.00	28.00	26.00	24.00	22.00	20.00
10	24.00	18.00	26.00	25.00	26.00	26.00	25.00	28.00	19.00	24.00
11	25.00	23.00	29.00	16.00	23.00	27.00	24.00	25.00	26.00	28.00
12	24.00	23.00	26.00	16.00	27.00	26.00	26.00	28.00	26.00	23.00
13	25.00	28.00	28.00	24.00	24.00	29.00	25.00	22.00	29.00	17.00
14	20.00	23.00	19.00	25.00	26.00	24.00	27.00	29.00	31.00	19.00
15	20.00	22.00	24.00	26.00	25.00	27.00	26.00	22.00	24.00	27.00
16	19.00	17.00	23.00	27.00	26.00	29.00	30.00	25.00	26.00	21.00
17	19.00	24.00	25.00	30.00	23.00	32.00	31.00	27.00	25.00	21.00
18	28.00	26.00	31.00	30.00	25.00	26.00	27.00	28.00	26.00	15.00
19	21.00	28.00	30.00	29.00	22.00	24.00	25.00	27.00	32.00	20.00
20	17.00	23.00	28.00	30.00	20.00	26.00	25.00	26.00	32.00	20.00

**HISTOGRAMA DE LO DATOS RECOLECTADOS**





**CALCULO DEL RANGO "D"**

Se depuran un total de 10% de los datos siendo 5% por cada extremo del histograma

<b>Lado izquierdo</b>	
Valor a dividir (di) =	<b>6</b>
Existente (ei) =	6
Faltante (fi) =	<b>4</b>

<b>Lado derecho</b>	
Valor a dividir (dd) =	<b>6</b>
Existente (ed) =	9
Faltante (fd) =	<b>1</b>

N° de intervalos

Rango medio (dm) = **8**

Entonces "D" viene a ser:

$$D = \left( \frac{(d_i - f_i)}{d_i} + d_m + \frac{(d_d - f_d)}{d_d} \right) * 5 \text{ [mm]}$$

D= 45 mm

**CÁLCULO FACTOR DE CORRECCIÓN fc:**

Donde:

Ep = 6.2  
 Li = 25  
 Lf = 15

$$f_c = \left( \frac{(E_p * 10)}{(L_i - L_f) * 5} \right)$$

fc = 1.24 mm

**CÁLCULO DEL RANGO CORREGIDO Dc:**

$$D_c = D * f_c$$

Dc = 56.83 mm

**DETERMINACIÓN DEL I.R.I.:**

Para pavimentos nuevos:

$$I.R.I. = 0.0485 * D_c$$

→ (IRI < 2.4)

Para pavimentos en servicio:

$$I.R.I. = 0.593 + 0.0471 * D_c$$

→ (2.4 < IRI < 15.9)

**CÁLCULO DEL I.R.I.:**

Aplicando la fórmula para pavimentos en servicio:

$$I.R.I. = 0.593 + 0.0471 * D_c$$

I.R.I. = 3.27 m/km





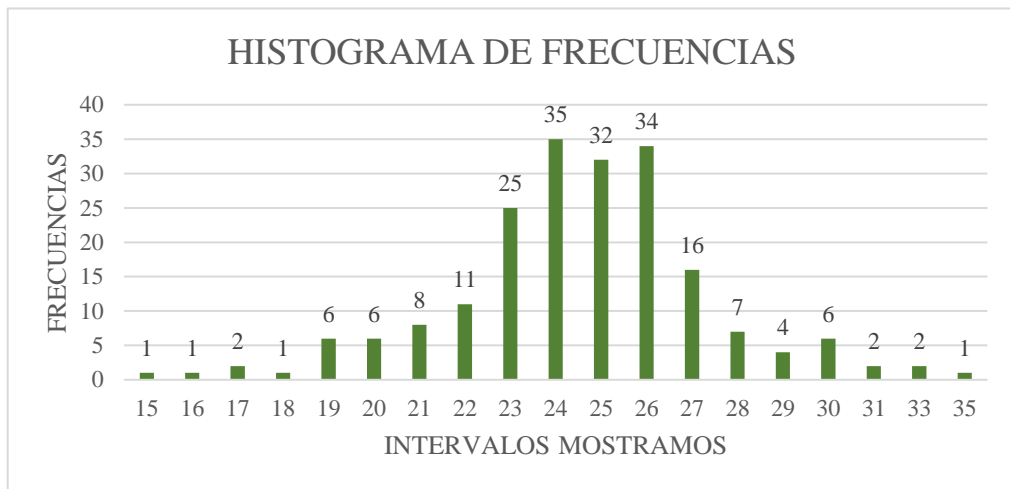
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 CARRERA DE INGENIERIA CIVIL  
 LABORATORIO DE ASFALTOS

**Nombre del tramo:** Ruta Nacional 1 (Cruce Calamuchita – Entrada a Muturayo)

**Carril de vuelta** Progresiva: 0+800 a 0+400

	1	2	3	4	5	6	7	8	9	10
1	24.00	28.00	26.00	25.00	26.00	27.00	24.00	24.00	31.00	25.00
2	26.00	21.00	24.00	24.00	22.00	26.00	27.00	23.00	27.00	24.00
3	24.00	35.00	24.00	26.00	23.00	27.00	25.00	21.00	24.00	23.00
4	23.00	26.00	25.00	29.00	24.00	26.00	23.00	24.00	23.00	29.00
5	26.00	25.00	25.00	26.00	24.00	23.00	22.00	23.00	26.00	26.00
6	25.00	27.00	27.00	25.00	25.00	25.00	28.00	27.00	17.00	25.00
7	28.00	25.00	26.00	24.00	26.00	26.00	24.00	26.00	24.00	24.00
8	23.00	26.00	25.00	23.00	21.00	24.00	21.00	25.00	26.00	23.00
9	27.00	25.00	25.00	24.00	27.00	23.00	20.00	26.00	25.00	23.00
10	28.00	25.00	25.00	23.00	26.00	24.00	22.00	25.00	22.00	26.00
11	24.00	26.00	27.00	21.00	26.00	21.00	23.00	24.00	19.00	26.00
12	30.00	18.00	25.00	29.00	25.00	24.00	26.00	25.00	22.00	24.00
13	23.00	23.00	26.00	31.00	26.00	26.00	24.00	26.00	27.00	22.00
14	22.00	24.00	28.00	27.00	19.00	24.00	26.00	24.00	19.00	24.00
15	24.00	25.00	25.00	19.00	20.00	23.00	28.00	15.00	26.00	28.00
16	25.00	25.00	27.00	24.00	21.00	21.00	24.00	17.00	27.00	26.00
17	23.00	24.00	26.00	25.00	25.00	23.00	16.00	24.00	22.00	33.00
18	22.00	23.00	25.00	27.00	20.00	25.00	22.00	24.00	30.00	33.00
19	23.00	24.00	25.00	26.00	20.00	26.00	30.00	23.00	30.00	23.00
20	19.00	20.00	27.00	19.00	20.00	29.00	30.00	22.00	30.00	23.00

**HISTOGRAMA DE LO DATOS RECOLECTADOS**





**CALCULO DEL RANGO "D"**

Se depuran un total de 10% de los datos siendo 5% por cada extremo del histograma

Lado izquierdo	
Valor a dividir (di) =	<b>6</b>
Existente (ei) =	<b>5</b>
Faltante (fi) =	<b>5</b>

Lado derecho	
Valor a dividir (dd) =	<b>6</b>
Existente (ed) =	<b>5</b>
Faltante (fd) =	<b>5</b>

N° de intervalos

Rango medio (dm) = **10**

Entonces "D" viene a ser:

$$D = \left( \frac{(d_i - f_i)}{d_i} + d_m + \frac{(d_a - f_a)}{d_a} \right) * 5 [mm]$$

D= 51.67 mm

**CÁLCULO FACTOR DE CORRECCIÓN fc:**

Donde:

Ep = 6.2  
 Li = 25  
 Lf = 15

$$f_c = \left( \frac{(E_p * 10)}{(L_i - L_f) * 5} \right)$$

fc = 1.24 mm

**CÁLCULO DEL RANGO CORREGIDO Dc:**

$$D_c = D * f_c$$

Dc = 64.07 mm

**DETERMINACIÓN DEL I.R.I.:**

Para pavimentos nuevos:

$$I. R. I. = 0.0485 * D_c$$

→ (IRI < 2.4)

Para pavimentos en servicio:

$$I. R. I. = 0.593 + 0.0471 * D_c$$

→ (2.4 < IRI < 15.9)

**CÁLCULO DEL I.R.I.:**

Aplicando la fórmula para pavimentos en servicio:

$$I. R. I. = 0.593 + 0.0471 * D_c$$

**I.R.I.= 3.61 m/km**



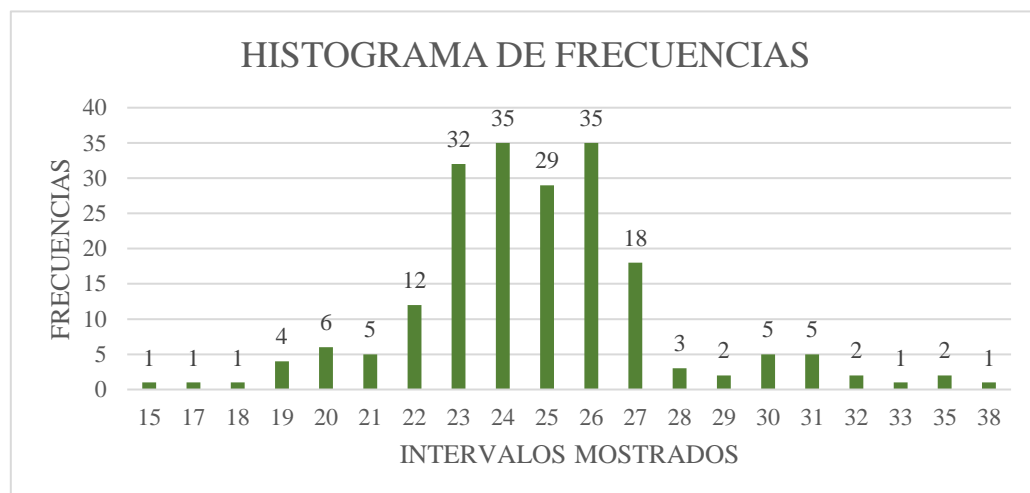
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 LABORATORIO DE ASFALTOS

**Nombre del tramo:** Ruta Nacional 1 (Cruce Calamuchita – Entrada a Muturayo)

**Carril de ida** Progresiva: 0+400 a 0+000

	1	2	3	4	5	6	7	8	9	10
1	23.00	24.00	26.00	19.00	26.00	18.00	27.00	25.00	23.00	24.00
2	22.00	23.00	27.00	27.00	25.00	23.00	23.00	27.00	27.00	25.00
3	31.00	23.00	25.00	26.00	25.00	24.00	26.00	24.00	26.00	26.00
4	24.00	26.00	22.00	22.00	26.00	23.00	23.00	25.00	24.00	31.00
5	22.00	25.00	22.00	26.00	25.00	23.00	25.00	26.00	21.00	24.00
6	24.00	25.00	26.00	24.00	24.00	27.00	22.00	24.00	24.00	25.00
7	25.00	26.00	24.00	23.00	26.00	24.00	24.00	27.00	25.00	23.00
8	24.00	25.00	25.00	22.00	25.00	23.00	26.00	24.00	26.00	25.00
9	23.00	24.00	28.00	22.00	26.00	23.00	24.00	26.00	33.00	24.00
10	22.00	29.00	23.00	23.00	22.00	26.00	20.00	24.00	26.00	23.00
11	27.00	27.00	19.00	26.00	27.00	15.00	25.00	21.00	21.00	26.00
12	20.00	25.00	27.00	23.00	23.00	23.00	24.00	27.00	20.00	25.00
13	20.00	20.00	26.00	24.00	21.00	24.00	29.00	22.00	27.00	27.00
14	27.00	30.00	25.00	23.00	31.00	25.00	26.00	22.00	28.00	24.00
15	26.00	25.00	24.00	23.00	26.00	24.00	19.00	23.00	27.00	31.00
16	25.00	26.00	24.00	26.00	28.00	26.00	26.00	27.00	21.00	25.00
17	25.00	23.00	26.00	17.00	24.00	25.00	23.00	24.00	24.00	30.00
18	26.00	23.00	24.00	19.00	23.00	23.00	30.00	26.00	38.00	32.00
19	25.00	25.00	27.00	24.00	24.00	26.00	30.00	35.00	35.00	32.00
20	23.00	23.00	23.00	26.00	26.00	23.00	30.00	31.00	20.00	24.00

### HISTOGRAMA DE LO DATOS RECOLECTADOS





**CALCULO DEL RANGO "D"**

Se depuran un total de 10% de los datos siendo 5% por cada extremo del histograma

Lado izquierdo	
Valor a dividir (di) =	<b>6</b>
Existente (ei) =	7
Faltante (fi) =	<b>3</b>

Lado derecho	
Valor a dividir (dd) =	<b>5</b>
Existente (ed) =	6
Faltante (fd) =	<b>4</b>

N° de intervalos

Rango medio (dm) = **10**

Entonces "D" viene a ser:

$$D = \left( \frac{(d_i - f_i)}{d_i} + d_m + \frac{(d_d - f_d)}{d_d} \right) * 5 [mm]$$

D= 53.5 mm

**CÁLCULO FACTOR DE CORRECCIÓN fc:**

Donde:

- Ep = 6.2
- Li = 25
- Lf = 15

$$f_c = \left( \frac{(E_p * 10)}{(L_i - L_f) * 5} \right)$$

fc = 1.24 mm

**CÁLCULO DEL RANGO CORREGIDO Dc:**

$$D_c = D * f_c$$

Dc = 66.34 mm

**DETERMINACIÓN DEL I.R.I.:**

Para pavimentos nuevos:

$$I. R. I. = 0.0485 * D_c$$

→ (IRI<2.4)

Para pavimentos en servicio:

$$I. R. I. = 0.593 + 0.0471 * D_c$$

→ (2.4<IRI<15.9)

**CÁLCULO DEL I.R.I.:**

Aplicando la fórmula para pavimentos en servicio:

$$I. R. I. = 0.593 + 0.0471 * D_c$$

**I.R.I.= 3.72 m/km**



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**LABORATORIO DE ASFALTOS**

**RESULTADOS OBTENIDOS**

Tramo rural	IRI rugosímetro de Merlín	
	Carril de ida	
	Huella 1	Huella 2
El Portillo-La Pintada (Cruce Ruta 11 Villamontes - Entrada al proyecto múltiples san jacinto - oficinas)	3.81	3.93
	3.40	3.61
	2.44	2.88
Carretera San Mateo – Sella (Monte Méndez - Barrio El Taco)	2.97	2.89
	3.08	2.89
	2.01	2.04
Ruta Nacional 1 (Cruce Calamuchita – Entrada a Muturayo)	4.01	3.95
	4.06	4.10
	3.12	3.22

Tramo rural	IRI rugosímetro de Merlín	
	Carril de vuelta	
	Huella 1	Huella 2
El Portillo-La Pintada (Cruce Ruta 11 Villamontes - Entrada al proyecto múltiples san jacinto - oficinas)	2.96	3.10
	3.02	3.54
	3.78	4.41
Carretera San Mateo – Sella (Monte Méndez - Barrio El Taco)	1.89	1.87
	2.33	2.36
	3.12	3.12
Ruta Nacional 1 (Cruce Calamuchita – Entrada a Muturayo)	3.15	3.27
	3.70	3.61
	3.81	3.72

Tramo rural	Media rugosímetro de Merlín	
	Ida	Vuelta
El Portillo-La Pintada (Cruce Ruta 11 Villamontes - Entrada al proyecto múltiples san jacinto - oficinas)	3.34	3.47
Carretera San Mateo – Sella (Monte Méndez - Barrio El Taco)	2.65	2.45
Ruta Nacional 1 (Cruce Calamuchita – Entrada a Muturayo)	3.74	3.54



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**ANEXO E**  
**DATOS Y CÁLCULO DE IRI ZONA URBANA**  
**APLICACIÓN ROADROID**

**DATOS DE CAMPO CON LA APLICACIÓN DEL ROADROID  
PARA EL CALCULO DEL IRI**

**Nombre del tramo:** Av. Jesús Molina (Cruce ruta San Jacinto - Casa del Mariachi)

**Carril de ida**

Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
3/29/2023 8:33:37 AM	-21.560667	-64.722158	20	26.84	1896.03	0	2.93	0.25	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:33:39 AM	- 21.5605902	- 64.7223521	40	32.58	1896.4	1.83	8.71	1.82	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:33:41 AM	- 21.5605212	- -64.72251	60	35.99	1896.6	1	3.93	3.17	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:33:43 AM	- 21.5604367	- 64.7226946	80	39.93	1896.83	1.17	5.51	2.35	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:33:45 AM	- 21.5603374	- 64.7229148	100	43.11	1897.05	1.08	6.26	3.12	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:33:46 AM	- 21.5603201	- -64.722953	120	45.82	1897.37	1.58	2.08	2.33	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:33:48 AM	- 21.5602003	- 64.7232295	140	46.94	1897.75	1.92	4.46	3.3	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:33:49 AM	- 21.5601798	- 64.7232828	160	46.81	1897.77	0.08	11.16	2.42	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:33:51 AM	- 21.5600844	- 64.7235749	180	48.13	1897.6	-0.83	12.14	2.22	(Cruce ruta San Jacinto - Casa del Mariachi)



Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
3/29/2023 8:33:52 AM	-21.560068	- 64.7236448	200	51.76	1897.33	-1.33	3.24	3.57	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:33:54 AM	-21.56001	- 64.7240139	220	54.61	1897	-1.67	4.35	2.17	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:33:55 AM	- 21.5599978	- 64.7241174	240	55.05	1896.8	-1	6.86	2.18	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:33:56 AM	- 21.5599865	- 64.7242175	260	55.53	1896.33	-2.33	4.5	3.02	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:33:58 AM	- 21.5599456	- 64.7246027	280	54.47	1896.25	-0.42	3.72	2.61	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:33:59 AM	- 21.5599356	- 64.7246959	300	52.58	1896.45	1	5.18	3.39	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:34:00 AM	-21.559926	- 64.7247846	320	52.28	1896.73	1.42	4.51	2.72	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:34:02 AM	- 21.5599014	- 64.7251648	340	52.98	1897.25	2.58	2.15	3.21	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:34:03 AM	- 21.5599051	- 64.7252619	360	53.36	1897.85	3	4.07	2.46	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:34:04 AM	- 21.5599108	- 64.7253577	380	53.4	1898.67	4.08	4.2	2.12	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:34:06 AM	- 21.5599606	- 64.7257446	400	53.89	1899.3	3.17	2.41	2.37	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:34:07 AM	-21.559976	- 64.7258461	420	54.51	1899.9	3	3.2	3.42	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:34:08 AM	- 21.5599909	- 64.7259494	440	54.91	1901.07	5.83	4.59	2.35	(Cruce ruta San Jacinto - Casa del Mariachi)

Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
3/29/2023 8:34:10 AM	- 21.5600481	- 64.7263491	460	55.22	1902.25	5.92	2.24	2.62	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:34:11 AM	- 21.5600659	- 64.7264559	480	55.5	1903.2	4.75	2.63	3.07	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:34:12 AM	- 21.5600837	- 64.7265609	500	55.65	1904.7	7.5	2.79	3.47	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:34:14 AM	- 21.5601462	- 64.7269573	520	55.19	1906.3	8	3.08	2.77	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:34:15 AM	- 21.5601576	- 64.7270567	540	54.49	1907.65	6.75	2.51	2.63	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:34:16 AM	- 21.5601668	- 64.7271497	560	52.7	1909.93	11.42	7.24	3.11	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:34:18 AM	- 21.5601771	- 64.7275078	580	51.38	1912.1	10.83	9.47	2.75	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:34:19 AM	- 21.5601751	- 64.7275837	600	50.24	1913.5	7	1.99	3.14	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:34:20 AM	- 21.5601729	- 64.7276531	620	48.96	1915.73	11.17	3.25	3.71	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:34:22 AM	- 21.5601426	- 64.7279703	640	46.63	1918.63	14.5	4.28	2.04	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:34:24 AM	- 21.5601033	- 64.7282614	660	45.08	1920.5	9.33	5.63	2.61	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:34:25 AM	- 21.5600965	- 64.7283055	680	43.88	1922.37	9.33	6.56	2.32	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:34:27 AM	- 21.5600618	- 64.7285742	700	42.04	1924.8	12.17	6.37	2.93	(Cruce ruta San Jacinto - Casa del Mariachi)

Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
3/29/2023 8:34:29 AM	-21.560053	64.7288316	720	40.97	1926.75	9.75	6.98	2.72	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:34:30 AM	21.5600543	64.7288558	740	38.28	1928.5	8.75	10.1	1.94	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:34:32 AM	21.5600764	64.7290713	760	37.2	1930.33	9.17	5.94	3.11	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:34:34 AM	21.5601042	-64.729284	780	37.76	1932.1	8.83	4.9	3.07	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:34:36 AM	21.5601306	64.7294986	800	38.06	1933.87	8.83	5.23	2.69	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:34:38 AM	21.5601576	64.7297142	820	38.92	1935.53	8.33	4.68	3.01	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:34:40 AM	21.5601883	-64.729942	840	39.88	1937.13	8	3.66	2.32	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:34:42 AM	21.5602195	-64.730183	860	40.73	1938.25	5.58	2.42	2.13	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:34:43 AM	21.5602234	64.7302164	880	42.89	1938.97	3.58	2.65	3.01	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:34:45 AM	21.5602589	64.7304961	900	44.96	1939.7	3.67	2.12	2.89	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:34:46 AM	21.5602662	64.7305498	920	46.42	1940.43	3.67	2.04	2.57	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:34:48 AM	21.5603094	64.7308611	940	47.1	1941.05	3.08	3.6	2.44	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:34:49 AM	21.5603183	64.7309173	960	46.74	1941.4	1.75	3.29	2.6	(Cruce ruta San Jacinto - Casa del Mariachi)

Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
3/29/2023 8:34:51 AM	- 21.5603599	- 64.7312241	980	47.09	1941.6	1	3.96	3.67	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:34:53 AM	- 21.5603974	- 64.7315336	1000	46.64	1941.7	0.5	6.84	2.38	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:34:54 AM	- 21.5604043	- 64.7315892	1020	45.28	1941.8	0.5	5.24	4.55	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:34:56 AM	- 21.5604348	- 64.7318556	1040	37.96	1936.2	-28	3.26	2.33	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:34:58 AM	- 21.5604534	- 64.7320031	1060	24.24	1925.9	-51.5	5.81	2.5	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:35:02 AM	- 21.5604916	- 64.7322011	1080	24.91	1916.28	-48.12	2.82	1.9	(Cruce ruta San Jacinto - Casa del Mariachi)

### Depuración de datos

MEDIA

$$\bar{X} = \frac{\sum_{j=1}^n X_j}{n} = \frac{X_1 + X_2 + \dots + X_n}{n} = 0.269$$

VARIANZA

$$\sigma^2 = \frac{\sum_{j=1}^n (X_j - \mu)^2}{N} = \overline{(x - \mu)^2} = 0.401$$

DESVIACIÓN ESTANDAR

$$\sigma = \sqrt{\frac{\sum_{j=1}^n (X_j - \mu)^2}{N}} = \sqrt{\overline{(x - \mu)^2}} = 0.633$$

$$\text{RANGO } (\bar{x} \pm \sigma) = (2.653 - 4.672)$$

Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
3/29/2023 8:33:37 AM	- 21.5605212	- -64.72251	20	35.99	1896.6	1	3.93	3.17	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:33:39 AM	- 21.5604367	- 64.7226946	80	39.93	1896.83	1.17	5.51	2.35	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:33:41 AM	- 21.5603374	- 64.7229148	100	43.11	1897.05	1.08	6.26	3.12	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:33:43 AM	- 21.5603201	- -64.722953	120	45.82	1897.37	1.58	2.08	2.33	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:33:45 AM	- 21.5601798	- 64.7232828	160	46.81	1897.77	0.08	11.16	2.42	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:33:46 AM	- 21.5600844	- 64.7235749	180	48.13	1897.6	-0.83	12.14	2.22	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:33:48 AM	- -21.56001	- 64.7240139	220	54.61	1897	-1.67	4.35	2.17	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:33:49 AM	- 21.5599978	- 64.7241174	240	55.05	1896.8	-1	6.86	2.18	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:33:51 AM	- 21.5599865	- 64.7242175	260	55.53	1896.33	-2.33	4.5	3.02	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:33:52 AM	- 21.5599456	- 64.7246027	280	54.47	1896.25	-0.42	3.72	2.61	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:33:54 AM	- -21.559926	- 64.7247846	320	52.28	1896.73	1.42	4.51	2.72	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:33:55 AM	- 21.5599014	- 64.7251648	340	52.98	1897.25	2.58	2.15	3.21	(Cruce ruta San Jacinto - Casa del Mariachi)

Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
3/29/2023 8:33:56 AM	- 21.5599051	- 64.7252619	360	53.36	1897.85	3	4.07	2.46	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:33:58 AM	- 21.5599108	- 64.7253577	380	53.4	1898.67	4.08	4.2	2.12	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:33:59 AM	- 21.5599606	- 64.7257446	400	53.89	1899.3	3.17	2.41	2.37	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:34:00 AM	- 21.5599909	- 64.7259494	440	54.91	1901.07	5.83	4.59	2.35	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:34:02 AM	- 21.5600481	- 64.7263491	460	55.22	1902.25	5.92	2.24	2.62	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:34:03 AM	- 21.5600659	- 64.7264559	480	55.5	1903.2	4.75	2.63	3.07	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:34:04 AM	- 21.5601462	- 64.7269573	520	55.19	1906.3	8	3.08	2.77	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:34:06 AM	- 21.5601576	- 64.7270567	540	54.49	1907.65	6.75	2.51	2.63	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:34:07 AM	- 21.5601668	- 64.7271497	560	52.7	1909.93	11.42	7.24	3.11	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:34:08 AM	- 21.5601771	- 64.7275078	580	51.38	1912.1	10.83	9.47	2.75	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:34:10 AM	- 21.5601751	- 64.7275837	600	50.24	1913.5	7	1.99	3.14	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:34:11 AM	- 21.5601033	- 64.7282614	660	45.08	1920.5	9.33	5.63	2.61	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:34:12 AM	- 21.5600965	- 64.7283055	680	43.88	1922.37	9.33	6.56	2.32	(Cruce ruta San Jacinto - Casa del Mariachi)

Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
3/29/2023 8:34:14 AM	- 21.5600618	- 64.7285742	700	42.04	1924.8	12.17	6.37	2.93	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:34:15 AM	-21.560053	- 64.7288316	720	40.97	1926.75	9.75	6.98	2.72	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:34:16 AM	- 21.5600764	- 64.7290713	760	37.2	1930.33	9.17	5.94	3.11	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:34:18 AM	- 21.5601042	- -64.729284	780	37.76	1932.1	8.83	4.9	3.07	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:34:19 AM	- 21.5601306	- 64.7294986	800	38.06	1933.87	8.83	5.23	2.69	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:34:20 AM	- 21.5601576	- 64.7297142	820	38.92	1935.53	8.33	4.68	3.01	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:34:22 AM	- 21.5601883	- -64.729942	840	39.88	1937.13	8	3.66	2.32	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:34:24 AM	- 21.5602195	- -64.730183	860	40.73	1938.25	5.58	2.42	2.13	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:34:25 AM	- 21.5602234	- 64.7302164	880	42.89	1938.97	3.58	2.65	3.01	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:34:27 AM	- 21.5602589	- 64.7304961	900	44.96	1939.7	3.67	2.12	2.89	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:34:29 AM	- 21.5602662	- 64.7305498	920	46.42	1940.43	3.67	2.04	2.57	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:34:30 AM	- 21.5603094	- 64.7308611	940	47.1	1941.05	3.08	3.6	2.44	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:34:32 AM	- 21.5603183	- 64.7309173	960	46.74	1941.4	1.75	3.29	2.6	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:34:34 AM	- 21.5603974	- 64.7315336	1000	46.64	1941.7	0.5	6.84	2.38	(Cruce ruta San Jacinto - Casa del Mariachi)

Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
3/29/2023 8:34:36 AM	- 21.5604348	- 64.7318556	1040	37.96	1936.2	-28	3.26	2.33	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 8:34:38 AM	- 21.5604534	- 64.7320031	1060	24.24	1925.9	-51.5	5.81	2.5	(Cruce ruta San Jacinto - Casa del Mariachi)

**Nombre del tramo:** Av. Jesús Molina (Cruce ruta San Jacinto - Casa del Mariachi)

#### Carril de vuelta

Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
3/29/2023 9:00:21 AM	- -21.560553	- -64.7324	20	23.75	1941.9	0	2.83	0.56	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:00:23 AM	- 21.5605308	- 64.7322602	40	25.45	1940.9	-5	3.63	1.68	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:00:24 AM	- 21.5605104	- 64.7321205	60	24.59	1939.83	-5.33	2.14	1.32	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:00:30 AM	- 21.5604741	- 64.7318495	80	30.12	1939.47	-1.83	4.12	2.29	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:00:32 AM	- 21.5604543	- 64.7317087	100	33.78	1939.22	-1.21	5.99	3.16	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:00:35 AM	- 21.5604103	- 64.7313472	120	37.47	1939.4	0.88	3.62	2.61	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:00:36 AM	- 21.5604083	- 64.7313315	140	39.12	1939.6	1	4.12	2.51	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:00:38 AM	- 21.5603787	- 64.7311066	160	40.53	1939.53	-0.33	4.02	2.56	(Cruce ruta San Jacinto - Casa del Mariachi)



Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
3/29/2023 9:00:40 AM	-21.560345	-64.7308636	180	42.96	1939.63	0.5	3.6	3.12	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:00:42 AM	-21.5603093	-64.730593	200	44.88	1939.65	0.08	2.93	2.31	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:00:43 AM	-21.5603028	-64.7305487	220	45.74	1939.23	-2.08	3.3	3.15	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:00:45 AM	-21.5602585	-64.7302563	240	46.03	1938.8	-2.17	2.32	2.51	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:00:46 AM	-21.5602502	-64.7302023	260	46.45	1938	-4	5.83	3.16	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:00:48 AM	-21.5602077	-64.7299029	280	46.89	1936.6	-7	8.22	2.31	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:00:49 AM	-21.5601971	-64.7298414	300	48.08	1934.8	-9	7.26	2.51	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:00:51 AM	-21.5601483	-64.7295139	320	49.07	1932.8	-10	7.46	2.63	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:00:52 AM	-21.5601375	-64.7294418	340	48.99	1930.93	-9.33	4.65	2.14	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:00:54 AM	-21.5600918	-64.7291019	360	47.89	1929.15	-8.92	6.81	3.42	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:00:55 AM	-21.5600844	-64.7290404	380	45.87	1927	-10.75	6.5	2.33	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:00:57 AM	-21.5600638	-64.728741	400	45.39	1925.15	-9.25	5.12	3.12	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:00:58 AM	-21.5600635	-64.7286839	420	46.18	1923.77	-6.92	4.58	2.58	(Cruce ruta San Jacinto - Casa del Mariachi)

Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
3/29/2023 9:01:00 AM	- 21.5600997	- 64.7283785	440	47.84	1922.4	-6.83	3.73	3.01	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:01:01 AM	- 21.5601112	- 64.7283132	460	49.68	1920.8	-8	6.65	2.54	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:01:03 AM	- 21.5601635	- -64.727975	480	50.91	1918.8	-10	3.78	3.12	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:01:04 AM	- 21.5601726	- 64.7278958	500	51.93	1916.6	-11	4.7	3.2	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:01:06 AM	- 21.5601973	- 64.7275173	520	53.69	1914.25	-11.75	8.6	3.21	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:01:07 AM	- 21.5601975	- 64.7274153	540	55.46	1912.55	-8.5	14.49	3.12	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:01:08 AM	- 21.5601947	- 64.7273092	560	56.46	1910.07	-12.42	8.75	2.31	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:01:10 AM	- 21.5601555	- 64.7268965	580	57.48	1907.7	-11.83	5.01	3.01	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:01:11 AM	- 21.5601388	- 64.7267787	600	57.96	1906.35	-6.75	4.95	2.55	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:01:12 AM	- 21.5601228	- 64.7266588	620	58.02	1905.2	-5.75	4.66	3.01	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:01:13 AM	- 21.5601072	- 64.7265389	640	58.02	1904.4	-4	3.4	2.65	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:01:14 AM	- 21.5600906	- 64.7264191	660	57.48	1903.23	-5.83	4.74	3.15	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:01:16 AM	- 21.5600244	- 64.7259959	680	56.34	1902.05	-5.92	7.06	3.04	(Cruce ruta San Jacinto - Casa del Mariachi)

Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
3/29/2023 9:01:17 AM	- 21.5600077	- 64.7258884	700	54.8	1901.4	-3.25	6.88	2.51	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:01:18 AM	- 21.5599926	- 64.7257918	720	52.07	1900.47	-4.67	4.33	3.13	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:01:20 AM	- 21.5599405	- 64.7254356	740	49.79	1899.3	-5.83	2.1	2.23	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:01:21 AM	- 21.5599311	- 64.7253657	760	48.77	1897.9	-7	2.67	2.35	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:01:23 AM	- 21.5599168	- 64.7250253	780	49.84	1896.75	-5.75	3.72	3.02	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:01:24 AM	- 21.5599198	- 64.7249483	800	50.63	1896.35	-2	2.23	2.67	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:01:25 AM	- 21.5599237	- 64.7248711	820	51.1	1895.83	-2.58	2.21	2.76	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:01:27 AM	- 21.5599714	- -64.724529	840	51.87	1895.65	-0.92	4.55	3.1	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:01:28 AM	- -21.559984	- 64.7244495	860	50.4	1895.83	0.92	4.63	3.23	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:01:30 AM	- 21.5600277	- 64.7241139	880	47.39	1896	0.83	1.89	2.31	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:01:31 AM	- 21.5600346	- 64.7240574	900	44.74	1896.5	2.5	2.09	2.74	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:01:33 AM	- 21.5600695	- 64.7237689	920	44.33	1897.05	2.75	2.13	3.19	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:01:34 AM	- 21.5600775	- 64.7237198	940	45.82	1897.5	2.25	10.96	2.12	(Cruce ruta San Jacinto - Casa del Mariachi)

Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
3/29/2023 9:01:36 AM	- 21.5601517	- -64.723424	960	47.84	1898.3	4	8.14	2.35	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:01:37 AM	- 21.5601726	- 64.7233586	980	49.52	1899.17	4.33	3.59	3.39	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:01:39 AM	- 21.5602993	- 64.7230455	1000	50.45	1899.25	0.42	3.89	3.23	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:01:40 AM	- 21.5603316	- 64.7229756	1020	50.87	1898.7	-2.75	3.2	3.18	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:01:42 AM	-21.560481	- 64.7226659	1040	51.28	1898.05	-3.25	2.4	2.35	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:01:43 AM	-21.560516	- 64.7225948	1060	49.88	1897.63	-2.08	4.01	2.75	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:01:45 AM	- 21.5606554	- 64.7222906	1080	48.38	1897.35	-1.42	4.9	3.5	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:01:46 AM	- 21.5606818	- 64.7222344	1100	46.39	1897.1	-1.25	3.63	3.16	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:01:48 AM	- 21.5608031	- 64.7219646	1120	45.41	1896.95	-0.75	2.14	2.14	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:01:49 AM	- 21.5608228	- 64.7219139	1140	46.06	1897.13	0.92	5.25	2.43	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:01:51 AM	- 21.5609409	- 64.7216361	1160	40.56	1897.27	0.67	4.72	2.53	(Cruce ruta San Jacinto - Casa del Mariachi)

Depuración de datos

MEDIA

$$\bar{X} = \frac{\sum_{j=1}^n X_j}{n} = \frac{X_1 + X_2 + \dots + X_n}{n} = 2.694$$

VARIANZA

$$\sigma^2 = \frac{\sum_{j=1}^n (X_j - \mu)^2}{N} = \overline{(x - \mu)^2} = 0.283$$

DESVIACIÓN ESTANDAR

$$\sigma = \sqrt{\frac{\sum_{j=1}^n (X_j - \mu)^2}{N}} = \sqrt{\overline{(x - \mu)^2}} = 0.532$$

RANGO

$$(\bar{x} \pm \sigma) = (2.163 - 3.226)$$

Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
3/29/2023 9:00:30 AM	- 21.5604741	- 64.7318495	80	30.12	1939.47	-1.83	4.12	2.29	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:00:32 AM	- 21.5604543	- 64.7317087	100	33.78	1939.22	-1.21	5.99	3.16	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:00:35 AM	- 21.5604103	- 64.7313472	120	37.47	1939.4	0.88	3.62	2.61	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:00:36 AM	- 21.5604083	- 64.7313315	140	39.12	1939.6	1	4.12	2.51	(Cruce ruta San Jacinto - Casa del Mariachi)

Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
3/29/2023 9:00:38 AM	- 21.5603787	- 64.7311066	160	40.53	1939.53	-0.33	4.02	2.56	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:00:40 AM	-21.560345	- 64.7308636	180	42.96	1939.63	0.5	3.6	3.12	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:00:42 AM	- 21.5603093	- -64.730593	200	44.88	1939.65	0.08	2.93	2.31	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:00:43 AM	- 21.5603028	- 64.7305487	220	45.74	1939.23	-2.08	3.3	3.15	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:00:45 AM	- 21.5602585	- 64.7302563	240	46.03	1938.8	-2.17	2.32	2.51	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:00:46 AM	- 21.5602502	- 64.7302023	260	46.45	1938	-4	5.83	3.16	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:00:48 AM	- 21.5602077	- 64.7299029	280	46.89	1936.6	-7	8.22	2.31	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:00:49 AM	- 21.5601971	- 64.7298414	300	48.08	1934.8	-9	7.26	2.51	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:00:51 AM	- 21.5601483	- 64.7295139	320	49.07	1932.8	-10	7.46	2.63	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:00:55 AM	- 21.5600844	- 64.7290404	380	45.87	1927	-10.75	6.5	2.33	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:00:57 AM	- 21.5600638	- -64.728741	400	45.39	1925.15	-9.25	5.12	3.12	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:00:58 AM	- 21.5600635	- 64.7286839	420	46.18	1923.77	-6.92	4.58	2.58	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:01:00 AM	- 21.5600997	- 64.7283785	440	47.84	1922.4	-6.83	3.73	3.01	(Cruce ruta San Jacinto - Casa del Mariachi)

Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
3/29/2023 9:01:01 AM	- 21.5601112	- 64.7283132	460	49.68	1920.8	-8	6.65	2.54	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:01:03 AM	- 21.5601635	- 64.727975	480	50.91	1918.8	-10	3.78	3.12	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:01:04 AM	- 21.5601726	- 64.7278958	500	51.93	1916.6	-11	4.7	3.2	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:01:06 AM	- 21.5601973	- 64.7275173	520	53.69	1914.25	-11.75	8.6	3.21	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:01:07 AM	- 21.5601975	- 64.7274153	540	55.46	1912.55	-8.5	14.49	3.12	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:01:08 AM	- 21.5601947	- 64.7273092	560	56.46	1910.07	-12.42	8.75	2.31	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:01:10 AM	- 21.5601555	- 64.7268965	580	57.48	1907.7	-11.83	5.01	3.01	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:01:11 AM	- 21.5601388	- 64.7267787	600	57.96	1906.35	-6.75	4.95	2.55	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:01:12 AM	- 21.5601228	- 64.7266588	620	58.02	1905.2	-5.75	4.66	3.01	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:01:13 AM	- 21.5601072	- 64.7265389	640	58.02	1904.4	-4	3.4	2.65	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:01:14 AM	- 21.5600906	- 64.7264191	660	57.48	1903.23	-5.83	4.74	3.15	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:01:16 AM	- 21.5600244	- 64.7259959	680	56.34	1902.05	-5.92	7.06	3.04	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:01:17 AM	- 21.5600077	- 64.7258884	700	54.8	1901.4	-3.25	6.88	2.51	(Cruce ruta San Jacinto - Casa del Mariachi)

Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
3/29/2023 9:01:18 AM	- 21.5599926	- 64.7257918	720	52.07	1900.47	-4.67	4.33	3.13	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:01:20 AM	- 21.5599405	- 64.7254356	740	49.79	1899.3	-5.83	2.1	2.35	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:01:21 AM	- 21.5599311	- 64.7253657	760	48.77	1897.9	-7	2.67	2.35	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:01:23 AM	- 21.5599168	- 64.7250253	780	49.84	1896.75	-5.75	3.72	3.02	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:01:24 AM	- 21.5599198	- 64.7249483	800	50.63	1896.35	-2	2.23	2.67	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:01:25 AM	- 21.5599237	- 64.7248711	820	51.1	1895.83	-2.58	2.21	2.76	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:01:27 AM	- 21.5599714	- -64.724529	840	51.87	1895.65	-0.92	4.55	3.1	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:01:30 AM	- 21.5600277	- 64.7241139	880	47.39	1896	0.83	1.89	2.31	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:01:31 AM	- 21.5600346	- 64.7240574	900	44.74	1896.5	2.5	2.09	2.74	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:01:33 AM	- 21.5600695	- 64.7237689	920	44.33	1897.05	2.75	2.13	3.19	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:01:36 AM	- 21.5601517	- -64.723424	960	47.84	1898.3	4	8.14	2.23	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:01:40 AM	- 21.5603316	- 64.7229756	1020	50.87	1898.7	-2.75	3.2	3.18	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:01:42 AM	- -21.560481	- 64.7226659	1040	51.28	1898.05	-3.25	2.4	2.35	(Cruce ruta San Jacinto - Casa del Mariachi)



Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
3/29/2023 9:01:43 AM	-21.560516	-64.7225948	1060	49.88	1897.63	-2.08	4.01	2.75	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:01:46 AM	21.5606818	64.7222344	1100	46.39	1897.1	-1.25	3.63	3.16	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:01:49 AM	21.5608228	64.7219139	1140	46.06	1897.13	0.92	5.25	2.43	(Cruce ruta San Jacinto - Casa del Mariachi)
3/29/2023 9:01:51 AM	21.5609409	64.7216361	1160	40.56	1897.27	0.67	4.72	2.53	(Cruce ruta San Jacinto - Casa del Mariachi)

**Nombre del tramo:** Av. Felipe Palazón (Rotonda Los Leones - Calle 10)

**Carril de ida**

Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
3/29/2023 8:21:43 AM	-21.545292	-64.729292	20	27.3	1896.73	0	4.56	1.71	(Rotonda Los Leones - Calle 10)
3/29/2023 8:21:45 AM	21.5453876	64.7290919	40	34.86	1894.87	-9.33	10.43	4.59	(Rotonda Los Leones - Calle 10)

Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
3/29/2023 8:21:47 AM	- 21.5454795	- 64.7289144	60	38.96	1893.53	-6.67	9.28	5.97	(Rotonda Los Leones - Calle 10)
3/29/2023 8:21:49 AM	- 21.5455812	- 64.7287104	80	39.97	1892.5	-5.17	7.43	3.81	(Rotonda Los Leones - Calle 10)
3/29/2023 8:21:50 AM	- 21.5455885	- -64.728695	100	37.49	1891.57	-4.67	11.91	7.78	(Rotonda Los Leones - Calle 10)
3/29/2023 8:21:52 AM	- 21.5456795	- 64.7285191	120	37.06	1890.27	-6.5	15	9.31	(Rotonda Los Leones - Calle 10)
3/29/2023 8:21:54 AM	- 21.5457939	- 64.7283486	140	40.58	1889	-6.33	10.09	7.76	(Rotonda Los Leones - Calle 10)
3/29/2023 8:21:56 AM	- 21.5459614	- 64.7281678	160	44.55	1888.07	-4.67	7.36	5.56	(Rotonda Los Leones - Calle 10)
3/29/2023 8:21:58 AM	- 21.5461799	- 64.7279784	180	46.24	1887.65	-2.08	3.16	2.8	(Rotonda Los Leones - Calle 10)
3/29/2023 8:21:59 AM	- 21.5462254	- -64.727941	200	47.33	1887.1	-2.75	5.79	4.23	(Rotonda Los Leones - Calle 10)
3/29/2023 8:22:01 AM	- 21.5464676	- 64.7277463	220	48.15	1886.55	-2.75	6.72	5.11	(Rotonda Los Leones - Calle 10)
3/29/2023 8:22:02 AM	- 21.5465187	- 64.7277066	240	48.92	1885.97	-2.92	11.92	4.86	(Rotonda Los Leones - Calle 10)
3/29/2023 8:22:04 AM	- 21.5467771	- 64.7275038	260	49.98	1885.5	-2.33	20.4	7.88	(Rotonda Los Leones - Calle 10)
3/29/2023 8:22:05 AM	- -21.546838	- 64.7274573	280	51.39	1885.3	-1	9.88	6.65	(Rotonda Los Leones - Calle 10)
3/29/2023 8:22:06 AM	- 21.5469024	- 64.7274081	300	52.54	1885.07	-1.17	4.32	4.03	(Rotonda Los Leones - Calle 10)

Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
3/29/2023 8:22:08 AM	- 21.5471856	- 64.7271896	320	52.78	1885.2	0.67	5.05	5.69	(Rotonda Los Leones - Calle 10)
3/29/2023 8:22:09 AM	- 21.5472537	- 64.7271349	340	52.75	1885.45	1.25	4.16	5.4	(Rotonda Los Leones - Calle 10)
3/29/2023 8:22:10 AM	- 21.5473218	- 64.7270795	360	52.78	1885.53	0.42	3.55	3.64	(Rotonda Los Leones - Calle 10)
3/29/2023 8:22:12 AM	- 21.5476035	- 64.7268578	380	52.5	1885.45	-0.42	8.48	4.98	(Rotonda Los Leones - Calle 10)
3/29/2023 8:22:13 AM	- 21.5476729	- 64.7268031	400	53.28	1885.43	-0.08	8.39	5.29	(Rotonda Los Leones - Calle 10)
3/29/2023 8:22:15 AM	- 21.5479589	- 64.7265808	420	53.65	1885.3	-0.67	6.47	5.1	(Rotonda Los Leones - Calle 10)
3/29/2023 8:22:16 AM	- 21.5480325	- 64.7265239	440	53.76	1885.15	-0.75	6.54	5.05	(Rotonda Los Leones - Calle 10)
3/29/2023 8:22:17 AM	- 21.5481077	- 64.7264664	460	53.93	1885.03	-0.58	16.38	8.43	(Rotonda Los Leones - Calle 10)
3/29/2023 8:22:19 AM	- 21.5483969	- 64.7262351	480	54.16	1885.1	0.33	12.15	9.37	(Rotonda Los Leones - Calle 10)
3/29/2023 8:22:20 AM	- 21.5484712	- 64.7261757	500	54.23	1885.1	0	3.74	4.76	(Rotonda Los Leones - Calle 10)
3/29/2023 8:22:21 AM	- 21.5485463	- 64.7261159	520	54.25	1884.9	-1	4.13	4.45	(Rotonda Los Leones - Calle 10)
3/29/2023 8:22:22 AM	- 21.5486202	- 64.7260574	540	54.73	1884.63	-1.33	5.89	4.41	(Rotonda Los Leones - Calle 10)
3/29/2023 8:22:24 AM	- 21.5489192	-64.725821	560	55.38	1884.45	-0.92	5.68	3.79	(Rotonda Los Leones - Calle 10)

Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
3/29/2023 8:22:25 AM	- 21.5489973	- 64.7257583	580	55.01	1884.5	0.25	4.84	4.73	(Rotonda Los Leones - Calle 10)
3/29/2023 8:22:26 AM	- 21.5490748	- 64.7256952	600	54.94	1884.57	0.33	5.43	4.62	(Rotonda Los Leones - Calle 10)
3/29/2023 8:22:28 AM	- 21.5493738	- 64.7254573	620	54.75	1884.45	-0.58	5.18	3.81	(Rotonda Los Leones - Calle 10)
3/29/2023 8:22:29 AM	- -21.549449	- 64.7253977	640	53.64	1884.4	-0.25	6.45	5.6	(Rotonda Los Leones - Calle 10)
3/29/2023 8:22:30 AM	- 21.5495155	- 64.7253452	660	49.17	1884.57	0.83	7.42	5.32	(Rotonda Los Leones - Calle 10)
3/29/2023 8:22:32 AM	- 21.5497605	- 64.7251538	680	46.93	1884.5	-0.33	16.28	8.29	(Rotonda Los Leones - Calle 10)
3/29/2023 8:22:33 AM	- 21.5498064	- 64.7251173	700	47.86	1884.33	-0.83	12.7	7.8	(Rotonda Los Leones - Calle 10)
3/29/2023 8:22:35 AM	- 21.5500495	- 64.7249173	720	49.21	1883.95	-1.92	4.83	3.58	(Rotonda Los Leones - Calle 10)
3/29/2023 8:22:36 AM	- 21.5501042	- 64.7248722	740	50.24	1883.37	-2.92	3	3.15	(Rotonda Los Leones - Calle 10)
3/29/2023 8:22:38 AM	- 21.5503629	- 64.7246614	760	51.44	1883.15	-1.08	4.98	4.66	(Rotonda Los Leones - Calle 10)
3/29/2023 8:22:39 AM	- 21.5504283	- -64.724609	780	52.61	1883.15	0	7.75	5.07	(Rotonda Los Leones - Calle 10)
3/29/2023 8:22:40 AM	- 21.5504969	- 64.7245534	800	53.28	1883.23	0.42	8.84	6.8	(Rotonda Los Leones - Calle 10)
3/29/2023 8:22:42 AM	- 21.5507776	- 64.7243168	820	54.28	1883.25	0.08	3.6	3.58	(Rotonda Los Leones - Calle 10)

Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
3/29/2023 8:22:43 AM	-21.550849	- 64.7242542	840	54.74	1883.3	0.25	3.46	3.34	(Rotonda Los Leones - Calle 10)
3/29/2023 8:22:44 AM	-21.55092	- 64.7241913	860	53.34	1883.37	0.33	6.8	6.4	(Rotonda Los Leones - Calle 10)
3/29/2023 8:22:46 AM	- 21.5511978	- 64.7239536	880	51.58	1883.2	-0.83	6.14	6.01	(Rotonda Los Leones - Calle 10)
3/29/2023 8:22:47 AM	-21.551261	- 64.7238995	900	51.25	1882.93	-1.33	8.09	6.37	(Rotonda Los Leones - Calle 10)
3/29/2023 8:22:49 AM	- 21.5515211	- 64.7236632	920	52.15	1882.8	-0.67	8.65	5.62	(Rotonda Los Leones - Calle 10)
3/29/2023 8:22:50 AM	- 21.5515889	- 64.7236028	940	52.84	1882.5	-1.5	7.27	3.75	(Rotonda Los Leones - Calle 10)
3/29/2023 8:22:51 AM	-21.551656	- 64.7235432	960	52.2	1882.17	-1.67	14.82	7.88	(Rotonda Los Leones - Calle 10)
3/29/2023 8:22:53 AM	- 21.5519259	- 64.7233107	980	51.86	1882.15	-0.08	15.51	11.05	(Rotonda Los Leones - Calle 10)
3/29/2023 8:22:54 AM	- 21.5519905	- 64.7232559	1000	52.23	1882.1	-0.25	12.44	8.36	(Rotonda Los Leones - Calle 10)
3/29/2023 8:22:55 AM	- 21.5520613	- -64.723196	1020	53.41	1881.9	-1	17.92	9.85	(Rotonda Los Leones - Calle 10)
3/29/2023 8:22:57 AM	-21.552339	- 64.7229538	1040	54.32	1881.75	-0.75	13.45	8.69	(Rotonda Los Leones - Calle 10)
3/29/2023 8:22:58 AM	- 21.5524096	- 64.7228909	1060	55.11	1881.3	-2.25	4.86	4.63	(Rotonda Los Leones - Calle 10)
3/29/2023 8:22:59 AM	- 21.5524826	- 64.7228272	1080	55.23	1880.87	-2.17	12.72	7.78	(Rotonda Los Leones - Calle 10)

Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
3/29/2023 8:23:01 AM	- 21.5527722	- 64.7225824	1100	53.86	1880.8	-0.33	16.67	7.9	(Rotonda Los Leones - Calle 10)
3/29/2023 8:23:02 AM	- 21.5528329	- 64.7225316	1120	44.85	1880.47	-1.67	7.6	5.6	(Rotonda Los Leones - Calle 10)

### Depuración de datos

MEDIA

$$\bar{X} = \frac{\sum_{j=1}^n X_j}{n} = \frac{X_1 + X_2 + \dots + X_n}{n} = 5.762$$

VARIANZA

$$\sigma^2 = \frac{\sum_{j=1}^n (X_j - \mu)^2}{N} = \overline{(x - \mu)^2} = 3.986$$

DESVIACIÓN ESTANDAR

$$\sigma = \sqrt{\frac{\sum_{j=1}^n (X_j - \mu)^2}{N}} = \sqrt{\overline{(x - \mu)^2}} = 1.997$$

RANGO

$$(\bar{x} \pm \sigma) = (3.765 - 7.758)$$

Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
3/29/2023 8:21:43 AM	- 21.545388	- 64.729092	40	34.86	1894.87	-9.33	10.43	4.59	(Rotonda Los Leones - Calle 10)
3/29/2023 8:21:45 AM	-21.54548	- 64.728914	60	38.96	1893.53	-6.67	9.28	5.97	(Rotonda Los Leones - Calle 10)
3/29/2023 8:21:47 AM	- 21.545581	- -64.72871	80	39.97	1892.5	-5.17	7.43	3.81	(Rotonda Los Leones - Calle 10)
3/29/2023 8:21:49 AM	- 21.545961	- 64.728168	160	44.55	1888.07	-4.67	7.36	5.56	(Rotonda Los Leones - Calle 10)
3/29/2023 8:21:50 AM	- 21.546225	- 64.727941	200	47.33	1887.1	-2.75	5.79	4.23	(Rotonda Los Leones - Calle 10)
3/29/2023 8:21:52 AM	- 21.546468	- 64.727746	220	48.15	1886.55	-2.75	6.72	5.11	(Rotonda Los Leones - Calle 10)
3/29/2023 8:21:54 AM	- 21.546519	- 64.727707	240	48.92	1885.97	-2.92	11.92	4.86	(Rotonda Los Leones - Calle 10)
3/29/2023 8:21:56 AM	- 21.546902	- 64.727408	300	52.54	1885.07	-1.17	4.32	4.03	(Rotonda Los Leones - Calle 10)
3/29/2023 8:21:58 AM	- 21.547186	- -64.72719	320	52.78	1885.2	0.67	5.05	5.69	(Rotonda Los Leones - Calle 10)
3/29/2023 8:21:59 AM	- 21.547254	- 64.727135	340	52.75	1885.45	1.25	4.16	5.4	(Rotonda Los Leones - Calle 10)
3/29/2023 8:22:01 AM	- 21.547603	- 64.726858	380	52.5	1885.45	-0.42	8.48	4.98	(Rotonda Los Leones - Calle 10)
3/29/2023 8:22:02 AM	- 21.547673	- 64.726803	400	53.28	1885.43	-0.08	8.39	5.29	(Rotonda Los Leones - Calle 10)
3/29/2023 8:22:04 AM	- 21.547959	- 64.726581	420	53.65	1885.3	-0.67	6.47	5.1	(Rotonda Los Leones - Calle 10)
3/29/2023 8:22:05 AM	- 21.548033	- 64.726524	440	53.76	1885.15	-0.75	6.54	5.05	(Rotonda Los Leones - Calle 10)

Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
3/29/2023 8:22:06 AM	- 21.548471	- 64.726176	500	54.23	1885.1	0	3.74	4.76	(Rotonda Los Leones - Calle 10)
3/29/2023 8:22:08 AM	- 21.548546	- 64.726116	520	54.25	1884.9	-1	4.13	4.45	(Rotonda Los Leones - Calle 10)
3/29/2023 8:22:09 AM	- -21.54862	- 64.726057	540	54.73	1884.63	-1.33	5.89	4.41	(Rotonda Los Leones - Calle 10)
3/29/2023 8:22:10 AM	- 21.548919	- 64.725821	560	55.38	1884.45	-0.92	5.68	3.79	(Rotonda Los Leones - Calle 10)
3/29/2023 8:22:12 AM	- 21.548997	- 64.725758	580	55.01	1884.5	0.25	4.84	4.73	(Rotonda Los Leones - Calle 10)
3/29/2023 8:22:13 AM	- 21.549075	- 64.725695	600	54.94	1884.57	0.33	5.43	4.62	(Rotonda Los Leones - Calle 10)
3/29/2023 8:22:15 AM	- 21.549374	- 64.725457	620	54.75	1884.45	-0.58	5.18	3.81	(Rotonda Los Leones - Calle 10)
3/29/2023 8:22:16 AM	- 21.549449	- 64.725398	640	53.64	1884.4	-0.25	6.45	5.6	(Rotonda Los Leones - Calle 10)
3/29/2023 8:22:17 AM	- 21.549516	- 64.725345	660	49.17	1884.57	0.83	7.42	5.32	(Rotonda Los Leones - Calle 10)
3/29/2023 8:22:19 AM	- 21.550363	- 64.724661	760	51.44	1883.15	-1.08	4.98	4.66	(Rotonda Los Leones - Calle 10)
3/29/2023 8:22:20 AM	- 21.550428	- 64.724609	780	52.61	1883.15	0	7.75	5.07	(Rotonda Los Leones - Calle 10)
3/29/2023 8:22:21 AM	- 21.551198	- 64.723954	880	51.58	1883.2	-0.83	6.14	6.01	(Rotonda Los Leones - Calle 10)
3/29/2023 8:22:22 AM	- 21.551261	- -64.7239	900	51.25	1882.93	-1.33	8.09	6.37	(Rotonda Los Leones - Calle 10)



Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
3/29/2023 8:22:24 AM	- 21.551521	- 64.723663	920	52.15	1882.8	-0.67	8.65	5.62	(Rotonda Los Leones - Calle 10)
3/29/2023 8:22:25 AM	-21.55241	- 64.722891	1060	55.11	1881.3	-2.25	4.86	4.63	(Rotonda Los Leones - Calle 10)
3/29/2023 8:22:26 AM	- 21.552833	- 64.722532	1120	44.85	1880.47	-1.67	7.6	5.6	(Rotonda Los Leones - Calle 10)

**Nombre del tramo:** Av. Felipe Palazón (Rotonda Los Leones - Calle 10)

### Carril de vuelta

Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
3/29/2023 8:17:30 AM	- 21.552953	- 64.722357	20	27.69	1882.23	0	4.89	1.02	(Rotonda Los Leones - Calle 10)
3/29/2023 8:17:32 AM	-21.5528	- 64.722489	40	35.05	1880.8	-7.17	9.54	4.02	(Rotonda Los Leones - Calle 10)
3/29/2023 8:17:34 AM	- 21.552661	- 64.722618	60	38.81	1879.87	-4.67	11.83	7.07	(Rotonda Los Leones - Calle 10)
3/29/2023 8:17:36 AM	- 21.552496	- 64.722768	80	42.02	1879.2	-3.33	6.13	5.53	(Rotonda Los Leones - Calle 10)
3/29/2023 8:17:37 AM	- 21.552466	- 64.722795	100	45.73	1879.1	-0.5	2.42	2.3	(Rotonda Los Leones - Calle 10)
3/29/2023 8:17:39 AM	- 21.552237	- 64.722994	120	47.72	1879.2	0.5	7.53	3.14	(Rotonda Los Leones - Calle 10)

Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
3/29/2023 8:17:40 AM	- 21.552186	- 64.723036	140	47.96	1879.03	-0.83	9.85	6.8	(Rotonda Los Leones - Calle 10)
3/29/2023 8:17:42 AM	- 21.551942	- 64.723237	160	47.85	1878.8	-1.17	4.77	4.05	(Rotonda Los Leones - Calle 10)
3/29/2023 8:17:43 AM	- 21.551891	- 64.723282	180	48.73	1878.43	-1.83	14.66	7.11	(Rotonda Los Leones - Calle 10)
3/29/2023 8:17:45 AM	- 21.551644	- -64.7235	200	49.61	1878.15	-1.42	16.02	7.77	(Rotonda Los Leones - Calle 10)
3/29/2023 8:17:46 AM	- 21.551586	- 64.723552	220	50.74	1878.33	0.92	2.65	3.29	(Rotonda Los Leones - Calle 10)
3/29/2023 8:17:48 AM	- 21.551322	- 64.723783	240	51.54	1878.7	1.83	2.42	3.58	(Rotonda Los Leones - Calle 10)
3/29/2023 8:17:49 AM	- 21.551258	- 64.723839	260	52.21	1878.65	-0.25	3.67	4.27	(Rotonda Los Leones - Calle 10)
3/29/2023 8:17:50 AM	- 21.551192	- 64.723896	280	53.01	1878.7	0.25	6.11	4.99	(Rotonda Los Leones - Calle 10)
3/29/2023 8:17:52 AM	- 21.550914	- -64.72414	300	54.38	1878.9	1	7.68	5.95	(Rotonda Los Leones - Calle 10)
3/29/2023 8:17:53 AM	- 21.550839	- 64.724206	320	55.51	1878.9	0	6.53	6.03	(Rotonda Los Leones - Calle 10)
3/29/2023 8:17:54 AM	- 21.550759	- 64.724276	340	56.2	1879	0.5	4.26	4.48	(Rotonda Los Leones - Calle 10)
3/29/2023 8:17:55 AM	- -21.55068	- 64.724344	360	56.41	1879.43	2.17	7.12	6.06	(Rotonda Los Leones - Calle 10)
3/29/2023 8:17:57 AM	- 21.550379	- 64.724598	380	56.54	1880.15	3.58	7.04	4.94	(Rotonda Los Leones - Calle 10)

Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
3/29/2023 8:17:58 AM	- 21.550296	- 64.724666	400	56.49	1880.65	2.5	14.69	8.66	(Rotonda Los Leones - Calle 10)
3/29/2023 8:17:59 AM	- 21.550216	- 64.724731	420	55.83	1881.03	1.92	12.1	8.4	(Rotonda Los Leones - Calle 10)
3/29/2023 8:18:01 AM	- 21.549916	- 64.724968	440	54.95	1881.3	1.33	8.05	6.73	(Rotonda Los Leones - Calle 10)
3/29/2023 8:18:02 AM	- 21.549843	- 64.725025	460	54.63	1881.7	2	14.76	5.44	(Rotonda Los Leones - Calle 10)
3/29/2023 8:18:03 AM	- 21.549773	- 64.725082	480	52.58	1882.03	1.67	17.35	8.87	(Rotonda Los Leones - Calle 10)
3/29/2023 8:18:05 AM	- 21.549502	- 64.725304	500	50.04	1882.05	0.08	7.24	3.99	(Rotonda Los Leones - Calle 10)
3/29/2023 8:18:06 AM	- 21.549447	- 64.725346	520	49.01	1882.4	1.75	5.08	4.13	(Rotonda Los Leones - Calle 10)
3/29/2023 8:18:08 AM	- 21.549199	- 64.725532	540	48.11	1883.1	3.5	2.62	3.53	(Rotonda Los Leones - Calle 10)
3/29/2023 8:18:09 AM	- 21.549151	- 64.725571	560	48.86	1883.63	2.67	2.71	3.72	(Rotonda Los Leones - Calle 10)
3/29/2023 8:18:11 AM	- 21.548898	- 64.725777	580	49.19	1883.95	1.58	3.34	3.12	(Rotonda Los Leones - Calle 10)
3/29/2023 8:18:12 AM	- 21.548843	- 64.725821	600	49.48	1883.95	0	6.72	3.26	(Rotonda Los Leones - Calle 10)
3/29/2023 8:18:13 AM	- 21.548785	- 64.725868	620	49.68	1884.2	1.25	9.55	5.32	(Rotonda Los Leones - Calle 10)
3/29/2023 8:18:15 AM	- 21.548525	- 64.726083	640	49.7	1884.45	1.25	3.49	3.32	(Rotonda Los Leones - Calle 10)

Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
3/29/2023 8:18:16 AM	- 21.548467	- -64.72613	660	50.1	1884.63	0.92	3.13	3.7	(Rotonda Los Leones - Calle 10)
3/29/2023 8:18:18 AM	- 21.548206	- -64.72634	680	50.06	1884.75	0.58	11.09	6.51	(Rotonda Los Leones - Calle 10)
3/29/2023 8:18:19 AM	- 21.548145	- 64.726389	700	50.95	1885.1	1.75	9.6	6.83	(Rotonda Los Leones - Calle 10)
3/29/2023 8:18:21 AM	- 21.547876	- 64.726602	720	51.51	1885.6	2.5	7.43	5.34	(Rotonda Los Leones - Calle 10)
3/29/2023 8:18:22 AM	- 21.547814	- 64.726649	740	51.28	1885.8	1	7.89	5.21	(Rotonda Los Leones - Calle 10)
3/29/2023 8:18:23 AM	- -21.54775	- 64.726698	760	51.79	1885.97	0.83	8.48	5.56	(Rotonda Los Leones - Calle 10)
3/29/2023 8:18:25 AM	- 21.547476	- 64.726923	780	52.56	1886.4	2.17	10.15	7.89	(Rotonda Los Leones - Calle 10)
3/29/2023 8:18:26 AM	- -21.54741	- 64.726975	800	52.63	1886.5	0.5	5.32	5.27	(Rotonda Los Leones - Calle 10)
3/29/2023 8:18:27 AM	- 21.547345	- 64.727027	820	52	1886.4	-0.5	10.28	4.89	(Rotonda Los Leones - Calle 10)
3/29/2023 8:18:29 AM	- 21.547073	- 64.727238	840	51.31	1886.65	1.25	11.03	4.59	(Rotonda Los Leones - Calle 10)
3/29/2023 8:18:30 AM	- -21.54701	- 64.727287	860	50.35	1887	1.75	3.19	3.38	(Rotonda Los Leones - Calle 10)
3/29/2023 8:18:32 AM	- 21.546749	- 64.727497	880	49.05	1887.2	1	4.77	3.31	(Rotonda Los Leones - Calle 10)
3/29/2023 8:18:33 AM	- 21.546695	- -64.72754	900	48.27	1887.43	1.17	7.34	4.89	(Rotonda Los Leones - Calle 10)

Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
3/29/2023 8:18:35 AM	- 21.546446	- 64.727736	920	47.24	1887.6	0.83	7.6	4.38	(Rotonda Los Leones - Calle 10)
3/29/2023 8:18:36 AM	- 21.546402	- 64.727774	940	46.31	1887.73	0.67	7.92	4.66	(Rotonda Los Leones - Calle 10)
3/29/2023 8:18:38 AM	- 21.546177	- 64.727956	960	45.72	1887.9	0.83	6.44	3.93	(Rotonda Los Leones - Calle 10)
3/29/2023 8:18:39 AM	- -21.54614	- 64.727987	980	44.82	1888.03	0.67	6	3.88	(Rotonda Los Leones - Calle 10)
3/29/2023 8:18:41 AM	- 21.545932	- 64.728169	1000	44.37	1888.15	0.58	6.96	3.56	(Rotonda Los Leones - Calle 10)
3/29/2023 8:18:42 AM	- 21.545902	- 64.728198	1020	43.69	1888.23	0.42	10.01	5.93	(Rotonda Los Leones - Calle 10)
3/29/2023 8:18:44 AM	- 21.545733	- 64.728389	1040	41.43	1888.4	0.83	15.21	7.83	(Rotonda Los Leones - Calle 10)
3/29/2023 8:18:46 AM	- -21.54561	- 64.728589	1060	37.68	1888.53	0.67	12.8	8.37	(Rotonda Los Leones - Calle 10)
3/29/2023 8:18:48 AM	- 21.545518	- -64.72876	1080	33.13	1888.8	1.33	6.47	5.66	(Rotonda Los Leones - Calle 10)

Depuración de datos

MEDIA

$$\bar{X} = \frac{\sum_{j=1}^n X_j}{n} = \frac{X_1 + X_2 + \dots + X_n}{n} = 5.120$$

VARIANZA

$$\sigma^2 = \frac{\sum_{j=1}^n (x_j - \mu)^2}{N} = \overline{(x - \mu)^2} = 3.06$$

DESVIACIÓN ESTANDAR

$$\sigma = \sqrt{\frac{\sum_{j=1}^n (x_j - \mu)^2}{N}} = \sqrt{\overline{(x - \mu)^2}} = 1.749$$

RANGO

$$(\bar{x} \pm \sigma) = (3.370 - 6.869)$$

Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
3/29/2023 8:17:32 AM	-21.5528	64.722489	20	35.05	1880.8	-7.17	9.54	4.02	(Rotonda Los Leones - Calle 10)
3/29/2023 8:17:36 AM	21.552496	64.722768	40	42.02	1879.2	-3.33	6.13	5.53	(Rotonda Los Leones - Calle 10)
3/29/2023 8:17:40 AM	21.552186	64.723036	60	47.96	1879.03	-0.83	9.85	6.8	(Rotonda Los Leones - Calle 10)
3/29/2023 8:17:42 AM	21.551942	64.723237	80	47.85	1878.8	-1.17	4.77	4.05	(Rotonda Los Leones - Calle 10)
3/29/2023 8:17:48 AM	21.551322	64.723783	100	51.54	1878.7	1.83	2.42	3.58	(Rotonda Los Leones - Calle 10)
3/29/2023 8:17:49 AM	21.551258	64.723839	120	52.21	1878.65	-0.25	3.67	4.27	(Rotonda Los Leones - Calle 10)
3/29/2023 8:17:50 AM	21.551192	64.723896	140	53.01	1878.7	0.25	6.11	4.99	(Rotonda Los Leones - Calle 10)
3/29/2023 8:17:52 AM	21.550914	-64.72414	160	54.38	1878.9	1	7.68	5.95	(Rotonda Los Leones - Calle 10)

Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
3/29/2023 8:17:53 AM	- 21.550839	- 64.724206	180	55.51	1878.9	0	6.53	6.03	(Rotonda Los Leones - Calle 10)
3/29/2023 8:17:54 AM	- 21.550759	- 64.724276	200	56.2	1879	0.5	4.26	4.48	(Rotonda Los Leones - Calle 10)
3/29/2023 8:17:55 AM	- -21.55068	- 64.724344	220	56.41	1879.43	2.17	7.12	6.06	(Rotonda Los Leones - Calle 10)
3/29/2023 8:17:57 AM	- 21.550379	- 64.724598	240	56.54	1880.15	3.58	7.04	4.94	(Rotonda Los Leones - Calle 10)
3/29/2023 8:18:01 AM	- 21.549916	- 64.724968	260	54.95	1881.3	1.33	8.05	6.73	(Rotonda Los Leones - Calle 10)
3/29/2023 8:18:02 AM	- 21.549843	- 64.725025	280	54.63	1881.7	2	14.76	5.44	(Rotonda Los Leones - Calle 10)
3/29/2023 8:18:05 AM	- 21.549502	- 64.725304	300	50.04	1882.05	0.08	7.24	3.99	(Rotonda Los Leones - Calle 10)
3/29/2023 8:18:06 AM	- 21.549447	- 64.725346	320	49.01	1882.4	1.75	5.08	4.13	(Rotonda Los Leones - Calle 10)
3/29/2023 8:18:08 AM	- 21.549199	- 64.725532	340	48.11	1883.1	3.5	2.62	3.53	(Rotonda Los Leones - Calle 10)
3/29/2023 8:18:09 AM	- 21.549151	- 64.725571	360	48.86	1883.63	2.67	2.71	3.72	(Rotonda Los Leones - Calle 10)
3/29/2023 8:18:13 AM	- 21.548785	- 64.725868	380	49.68	1884.2	1.25	9.55	5.32	(Rotonda Los Leones - Calle 10)
3/29/2023 8:18:16 AM	- 21.548467	-64.72613	400	50.1	1884.63	0.92	3.13	3.7	(Rotonda Los Leones - Calle 10)
3/29/2023 8:18:18 AM	- 21.548206	-64.72634	420	50.06	1884.75	0.58	11.09	6.51	(Rotonda Los Leones - Calle 10)

DateTime	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
3/29/2023 8:18:19 AM	- 21.548145	- 64.726389	440	50.95	1885.1	1.75	9.6	6.83	(Rotonda Los Leones - Calle 10)
3/29/2023 8:18:21 AM	- 21.547876	- 64.726602	460	51.51	1885.6	2.5	7.43	5.34	(Rotonda Los Leones - Calle 10)
3/29/2023 8:18:22 AM	- 21.547814	- 64.726649	480	51.28	1885.8	1	7.89	5.21	(Rotonda Los Leones - Calle 10)
3/29/2023 8:18:23 AM	- -21.54775	- 64.726698	500	51.79	1885.97	0.83	8.48	5.56	(Rotonda Los Leones - Calle 10)
3/29/2023 8:18:26 AM	- -21.54741	- 64.726975	520	52.63	1886.5	0.5	5.32	5.27	(Rotonda Los Leones - Calle 10)
3/29/2023 8:18:27 AM	- 21.547345	- 64.727027	540	52	1886.4	-0.5	10.28	4.89	(Rotonda Los Leones - Calle 10)
3/29/2023 8:18:29 AM	- 21.547073	- 64.727238	560	51.31	1886.65	1.25	11.03	4.59	(Rotonda Los Leones - Calle 10)
3/29/2023 8:18:30 AM	- -21.54701	- 64.727287	580	50.35	1887	1.75	3.19	3.38	(Rotonda Los Leones - Calle 10)
3/29/2023 8:18:33 AM	- 21.546695	- -64.72754	600	48.27	1887.43	1.17	7.34	4.89	(Rotonda Los Leones - Calle 10)
3/29/2023 8:18:35 AM	- 21.546446	- 64.727736	620	47.24	1887.6	0.83	7.6	4.38	(Rotonda Los Leones - Calle 10)
3/29/2023 8:18:36 AM	- 21.546402	- 64.727774	640	46.31	1887.73	0.67	7.92	4.66	(Rotonda Los Leones - Calle 10)
3/29/2023 8:18:38 AM	- 21.546177	- 64.727956	660	45.72	1887.9	0.83	6.44	3.93	(Rotonda Los Leones - Calle 10)
3/29/2023 8:18:39 AM	- -21.54614	- 64.727987	680	44.82	1888.03	0.67	6	3.88	(Rotonda Los Leones - Calle 10)



Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
3/29/2023 8:18:41 AM	- 21.545932	- 64.728169	700	44.37	1888.15	0.58	6.96	3.56	(Rotonda Los Leones - Calle 10)
3/29/2023 8:18:42 AM	- 21.545902	- 64.728198	720	43.69	1888.23	0.42	10.01	5.93	(Rotonda Los Leones - Calle 10)
3/29/2023 8:18:48 AM	- 21.545518	- -64.72876	740	33.13	1888.8	1.33	6.47	5.66	(Rotonda Los Leones - Calle 10)

### RESULTADOS OBTENIDOS

Tramo urbano	Media aplicación ROADROID	
	Ida	Vuelta
Av. Jesús Molina (Cruce ruta San Jacinto - Casa del Mariachi)	2.65	2.76
Av. Felipe Palazón (Rotonda Los Leones - Calle 10)	4.97	4.91



**ANEXO F**

**DATOS Y CÁLCULO DE IRI ZONA RURAL**  
**APLICACIÓN ROADROID**

**DATOS DE CAMPO CON LA APLICACIÓN DEL ROADROID  
PARA EL CALCULO DEL IRI**

**Nombre del tramo:** El Portillo-La Pintada (Cruce Ruta 11 Villamontes - Entrada al proyecto múltiples san Jacinto - oficinas)  
múltiples san Jacinto - oficinas)

**Carril de ida**

Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
3/22/2023 1:55:45 PM	-21.578203	-64.662603	20	24.08	1885.03	0	4.77	0.04	El Portillo - La Pintada ida
3/22/2023 1:55:47 PM	-21.5780798	-64.6626896	40	34.28	1885.1	0.33	3.53	0.78	El Portillo - La Pintada ida
3/22/2023 1:55:49 PM	-21.5778952	-64.6628062	60	43.02	1885.17	0.33	3.39	1.79	El Portillo - La Pintada ida
3/22/2023 1:55:51 PM	-21.5776506	-64.6629576	80	47.62	1885.25	0.42	2.6	2.54	El Portillo - La Pintada ida
3/22/2023 1:55:52 PM	-21.5775886	-64.6629963	100	51.62	1885.05	-1	2.93	1.15	El Portillo - La Pintada ida

Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
3/22/2023 1:55:53 PM	- 21.5775126	- 64.6630439	120	56.71	1884.63	-2.08	4.33	2.46	El Portillo - La Pintada ida
3/22/2023 1:55:55 PM	- 21.5771608	- 64.663265	140	61.36	1884.45	-0.92	5.89	3.78	El Portillo - La Pintada ida
3/22/2023 1:55:56 PM	- 21.5770471	- 64.6633343	160	62.77	1884.4	-0.25	7.18	4.12	El Portillo - La Pintada ida
3/22/2023 1:55:57 PM	- 21.5769287	- 64.6634081	180	63.71	1884.35	-0.25	6.92	3.39	El Portillo - La Pintada ida
3/22/2023 1:55:58 PM	- 21.5768042	- 64.6634869	200	65.73	1884.1	-1.25	5.84	3.11	El Portillo - La Pintada ida
3/22/2023 1:55:59 PM	- 21.5766698	- 64.6635717	220	68.07	1883.8	-1.5	6.81	5.65	El Portillo - La Pintada ida
3/22/2023 1:56:00 PM	- 21.5765248	- 64.6636624	240	70.35	1883.65	-0.75	6.69	4.2	El Portillo - La Pintada ida
3/22/2023 1:56:01 PM	- 21.5763708	- 64.6637582	260	72.01	1883.65	0	8.92	5.19	El Portillo - La Pintada ida
3/22/2023 1:56:02 PM	- 21.5762126	- 64.6638574	280	72.43	1883.85	1	12.65	6.24	El Portillo - La Pintada ida
3/22/2023 1:56:03 PM	- -21.576054	- 64.6639559	300	72.43	1884.15	1.5	12.37	7.2	El Portillo - La Pintada ida
3/22/2023 1:56:04 PM	- 21.5758941	- 64.6640547	320	72.82	1884.3	0.75	8.58	4.72	El Portillo - La Pintada ida
3/22/2023 1:56:05 PM	- 21.5757304	- 64.6641568	340	73.73	1884.7	2	5.52	3.15	El Portillo - La Pintada ida
3/22/2023 1:56:06 PM	- 21.5755621	- 64.6642598	360	74.49	1885.45	3.75	3.97	3.65	El Portillo - La Pintada ida

Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
3/22/2023 1:56:07 PM	- 21.5753926	- 64.6643614	380	74.64	1886	2.75	3.59	2.68	El Portillo - La Pintada ida
3/22/2023 1:56:08 PM	- 21.5752265	- 64.6644605	400	73.85	1886.65	3.25	5.52	4.24	El Portillo - La Pintada ida
3/22/2023 1:56:09 PM	- 21.5750634	- 64.6645599	420	72.69	1887.75	5.5	12.11	6.89	El Portillo - La Pintada ida
3/22/2023 1:56:10 PM	- 21.5749039	- 64.6646584	440	71.61	1888.95	6	11.22	7.61	El Portillo - La Pintada ida
3/22/2023 1:56:11 PM	- 21.5747519	- 64.6647532	460	70.44	1890.05	5.5	5.79	3.64	El Portillo - La Pintada ida
3/22/2023 1:56:12 PM	- 21.5746056	- 64.6648453	480	69.36	1891.05	5	5.33	3.64	El Portillo - La Pintada ida
3/22/2023 1:56:13 PM	- 21.5744634	- 64.6649345	500	68.16	1891.85	4	3.71	2.16	El Portillo - La Pintada ida
3/22/2023 1:56:14 PM	- 21.5743274	- 64.6650192	520	66.77	1892.65	4	3.88	2.82	El Portillo - La Pintada ida
3/22/2023 1:56:15 PM	- 21.5741968	- 64.6651005	540	65.3	1893.55	4.5	4.81	2.18	El Portillo - La Pintada ida
3/22/2023 1:56:16 PM	-21.57407	- 64.6651786	560	64.81	1894.35	4	5.19	3.68	El Portillo - La Pintada ida
3/22/2023 1:56:17 PM	- 21.5739446	- 64.6652562	580	64.86	1895	3.25	5.63	4.26	El Portillo - La Pintada ida
3/22/2023 1:56:18 PM	- 21.5738168	- 64.6653321	600	64.93	1896	5	5.99	3.36	El Portillo - La Pintada ida
3/22/2023 1:56:20 PM	- 21.5734057	- 64.6655865	620	65.13	1897	5	3.57	4.13	El Portillo - La Pintada ida

Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
3/22/2023 1:56:21 PM	- 21.5732807	- 64.6656642	640	64.98	1897.85	4.25	3.7	2.72	El Portillo - La Pintada ida
3/22/2023 1:56:22 PM	- 21.5731549	- 64.6657422	660	65.12	1898.85	5	3.74	3.54	El Portillo - La Pintada ida
3/22/2023 1:56:23 PM	- 21.5730271	- 64.6658213	680	65.18	1899.7	4.25	3.02	2.87	El Portillo - La Pintada ida
3/22/2023 1:56:24 PM	- 21.5729001	- 64.6659009	700	65.25	1900.45	3.75	2.12	2.15	El Portillo - La Pintada ida
3/22/2023 1:56:25 PM	- -21.572773	- 64.6659804	720	65.36	1901.2	3.75	3.82	3.94	El Portillo - La Pintada ida
3/22/2023 1:56:26 PM	- 21.5726447	- 64.6660605	740	65.21	1901.85	3.25	7.82	2.61	El Portillo - La Pintada ida
3/22/2023 1:56:27 PM	- -21.572516	- 64.6661416	760	64.97	1902.5	3.25	7.27	4.15	El Portillo - La Pintada ida
3/22/2023 1:56:28 PM	- 21.5723876	- 64.6662206	780	65.08	1903.37	4.33	5.43	3.21	El Portillo - La Pintada ida
3/22/2023 1:56:30 PM	- 21.5719808	- 64.6664726	800	64.99	1904.25	4.42	5.3	4.37	El Portillo - La Pintada ida
3/22/2023 1:56:31 PM	- 21.5718557	- -64.666553	820	65.15	1904.8	2.75	3.94	2.76	El Portillo - La Pintada ida
3/22/2023 1:56:32 PM	- 21.5717286	- 64.6666337	840	65.33	1905.25	2.25	6.32	3.35	El Portillo - La Pintada ida
3/22/2023 1:56:33 PM	- 21.5716003	- 64.6667137	860	65.13	1905.8	2.75	8.68	6.54	El Portillo - La Pintada ida
3/22/2023 1:56:34 PM	- 21.5714732	- 64.6667933	880	64.95	1906.5	3.5	6.35	4.33	El Portillo - La Pintada ida

Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
3/22/2023 1:56:35 PM	- 21.5713461	- 64.6668728	900	65.16	1907	2.5	3.86	3.17	El Portillo - La Pintada ida
3/22/2023 1:56:36 PM	- 21.5712184	-64.666952	920	65.49	1907.3	1.5	6.04	5.8	El Portillo - La Pintada ida
3/22/2023 1:56:37 PM	- 21.5710912	- 64.6670312	940	65.67	1907.6	1.5	6.57	3.85	El Portillo - La Pintada ida
3/22/2023 1:56:38 PM	-21.570962	- 64.6671126	960	66.05	1907.95	1.75	8.05	4.67	El Portillo - La Pintada ida
3/22/2023 1:56:39 PM	- 21.5708299	- 64.6671949	980	66.11	1908.3	1.75	10.56	6.49	El Portillo - La Pintada ida
3/22/2023 1:56:41 PM	- 21.5704155	- 64.6674517	1000	64.76	1908.6	1.5	7.12	4.23	El Portillo - La Pintada ida
3/22/2023 1:56:42 PM	-21.570291	- 64.6675273	1020	64.19	1908.65	0.25	9.58	5.32	El Portillo - La Pintada ida
3/22/2023 1:56:43 PM	- 21.5701696	- 64.6676042	1040	64.41	1908.55	-0.5	12.11	7.62	El Portillo - La Pintada ida
3/22/2023 1:56:44 PM	-21.570048	- 64.6676807	1060	64.8	1908.35	-1	7.92	4.61	El Portillo - La Pintada ida
3/22/2023 1:56:45 PM	- 21.5699248	-64.667758	1080	64.98	1908.2	-0.75	5.35	2.83	El Portillo - La Pintada ida
3/22/2023 1:56:46 PM	- 21.5698007	- 64.6678356	1100	64.31	1908.05	-0.75	5.79	3.52	El Portillo - La Pintada ida
3/22/2023 1:56:47 PM	- 21.5696903	- 64.6679032	1120	56.76	1907.3	-3.75	8.91	4.2	El Portillo - La Pintada ida
3/22/2023 1:56:49 PM	-21.569386	-64.668077	1140	44.51	1906.55	-3.75	6.81	4.31	El Portillo - La Pintada ida

Depuración de datos



MEDIA

$$\bar{X} = \frac{\sum_{j=1}^n X_j}{n} = \frac{X_1 + X_2 + \dots + X_n}{n} = 3.888$$

VARIANZA

$$\sigma^2 = \frac{\sum_{j=1}^n (X_j - \mu)^2}{N} = \overline{(x - \mu)^2} = 2.543$$

DESVIACIÓN ESTANDAR

$$\sigma = \sqrt{\frac{\sum_{j=1}^n (X_j - \mu)^2}{N}} = \sqrt{\overline{(x - \mu)^2}} = 1.595$$

RANGO

$$(\bar{x} \pm \sigma) = (2.293 - 5.483)$$

Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
3/22/2023 1:55:51 PM	- 21.5776506	- 64.6629576	80	47.62	1885.25	0.42	2.6	2.54	El Portillo - La Pintada ida
3/22/2023 1:55:53 PM	- 21.5775126	- 64.6630439	120	56.71	1884.63	-2.08	4.33	2.46	El Portillo - La Pintada ida
3/22/2023 1:55:55 PM	- 21.5771608	- -64.663265	140	61.36	1884.45	-0.92	5.89	3.78	El Portillo - La Pintada ida

Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
3/22/2023 1:55:56 PM	- 21.5770471	- 64.6633343	160	62.77	1884.4	-0.25	7.18	4.12	El Portillo - La Pintada ida
3/22/2023 1:55:57 PM	- 21.5769287	- 64.6634081	180	63.71	1884.35	-0.25	6.92	3.39	El Portillo - La Pintada ida
3/22/2023 1:55:58 PM	- 21.5768042	- 64.6634869	200	65.73	1884.1	-1.25	5.84	3.11	El Portillo - La Pintada ida
3/22/2023 1:56:00 PM	- 21.5765248	- 64.6636624	240	70.35	1883.65	-0.75	6.69	4.2	El Portillo - La Pintada ida
3/22/2023 1:56:01 PM	- 21.5763708	- 64.6637582	260	72.01	1883.65	0	8.92	5.19	El Portillo - La Pintada ida
3/22/2023 1:56:04 PM	- 21.5758941	- 64.6640547	320	72.82	1884.3	0.75	8.58	4.72	El Portillo - La Pintada ida
3/22/2023 1:56:05 PM	- 21.5757304	- 64.6641568	340	73.73	1884.7	2	5.52	3.15	El Portillo - La Pintada ida
3/22/2023 1:56:06 PM	- 21.5755621	- 64.6642598	360	74.49	1885.45	3.75	3.97	3.65	El Portillo - La Pintada ida
3/22/2023 1:56:07 PM	- 21.5753926	- 64.6643614	380	74.64	1886	2.75	3.59	2.68	El Portillo - La Pintada ida
3/22/2023 1:56:08 PM	- 21.5752265	- 64.6644605	400	73.85	1886.65	3.25	5.52	4.24	El Portillo - La Pintada ida
3/22/2023 1:56:11 PM	- 21.5747519	- 64.6647532	460	70.44	1890.05	5.5	5.79	3.64	El Portillo - La Pintada ida
3/22/2023 1:56:12 PM	- 21.5746056	- 64.6648453	480	69.36	1891.05	5	5.33	3.64	El Portillo - La Pintada ida
3/22/2023 1:56:14 PM	- 21.5743274	- 64.6650192	520	66.77	1892.65	4	3.88	2.82	El Portillo - La Pintada ida

Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
3/22/2023 1:56:16 PM	-21.57407	64.6651786	560	64.81	1894.35	4	5.19	3.68	El Portillo - La Pintada ida
3/22/2023 1:56:17 PM	21.5739446	64.6652562	580	64.86	1895	3.25	5.63	4.26	El Portillo - La Pintada ida
3/22/2023 1:56:18 PM	21.5738168	64.6653321	600	64.93	1896	5	5.99	3.36	El Portillo - La Pintada ida
3/22/2023 1:56:20 PM	21.5734057	64.6655865	620	65.13	1897	5	3.57	4.13	El Portillo - La Pintada ida
3/22/2023 1:56:21 PM	21.5732807	64.6656642	640	64.98	1897.85	4.25	3.7	2.72	El Portillo - La Pintada ida
3/22/2023 1:56:22 PM	21.5731549	64.6657422	660	65.12	1898.85	5	3.74	3.54	El Portillo - La Pintada ida
3/22/2023 1:56:23 PM	21.5730271	64.6658213	680	65.18	1899.7	4.25	3.02	2.87	El Portillo - La Pintada ida
3/22/2023 1:56:25 PM	-21.572773	64.6659804	720	65.36	1901.2	3.75	3.82	3.94	El Portillo - La Pintada ida
3/22/2023 1:56:26 PM	21.5726447	64.6660605	740	65.21	1901.85	3.25	7.82	2.61	El Portillo - La Pintada ida
3/22/2023 1:56:27 PM	-21.572516	64.6661416	760	64.97	1902.5	3.25	7.27	4.15	El Portillo - La Pintada ida
3/22/2023 1:56:28 PM	21.5723876	64.6662206	780	65.08	1903.37	4.33	5.43	3.21	El Portillo - La Pintada ida
3/22/2023 1:56:30 PM	21.5719808	64.6664726	800	64.99	1904.25	4.42	5.3	4.37	El Portillo - La Pintada ida
3/22/2023 1:56:31 PM	21.5718557	-64.666553	820	65.15	1904.8	2.75	3.94	2.76	El Portillo - La Pintada ida

Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
3/22/2023 1:56:32 PM	- 21.5717286	- 64.6666337	840	65.33	1905.25	2.25	6.32	3.35	El Portillo - La Pintada ida
3/22/2023 1:56:34 PM	- 21.5714732	- 64.6667933	880	64.95	1906.5	3.5	6.35	4.33	El Portillo - La Pintada ida
3/22/2023 1:56:35 PM	- 21.5713461	- 64.6668728	900	65.16	1907	2.5	3.86	3.17	El Portillo - La Pintada ida
3/22/2023 1:56:37 PM	- 21.5710912	- 64.6670312	940	65.67	1907.6	1.5	6.57	3.85	El Portillo - La Pintada ida
3/22/2023 1:56:38 PM	-21.570962	- 64.6671126	960	66.05	1907.95	1.75	8.05	4.67	El Portillo - La Pintada ida
3/22/2023 1:56:41 PM	- 21.5704155	- 64.6674517	1000	64.76	1908.6	1.5	7.12	4.23	El Portillo - La Pintada ida
3/22/2023 1:56:42 PM	-21.570291	- 64.6675273	1020	64.19	1908.65	0.25	9.58	5.32	El Portillo - La Pintada ida
3/22/2023 1:56:44 PM	-21.570048	- 64.6676807	1060	64.8	1908.35	-1	7.92	4.61	El Portillo - La Pintada ida
3/22/2023 1:56:45 PM	- 21.5699248	-64.667758	1080	64.98	1908.2	-0.75	5.35	2.83	El Portillo - La Pintada ida
3/22/2023 1:56:46 PM	- 21.5698007	- 64.6678356	1100	64.31	1908.05	-0.75	5.79	3.52	El Portillo - La Pintada ida
3/22/2023 1:56:47 PM	- 21.5696903	- 64.6679032	1120	56.76	1907.3	-3.75	8.91	4.2	El Portillo - La Pintada ida
3/22/2023 1:56:49 PM	-21.569386	-64.668077	1140	44.51	1906.55	-3.75	6.81	4.31	El Portillo - La Pintada ida

**Nombre del tramo:** El Portillo – La Pintada (Cruce Ruta 11 Villamontes - Entrada al proyecto múltiples san Jacinto - oficinas)  
múltiples san Jacinto - oficinas)  
**Carril de vuelta**

Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
3/29/2023 7:58:23 AM	-21.577927	-64.662797	20	26.59	1884.2	0	1.52	0.04	El Portillo - La Pintada vuelta
3/29/2023 7:58:25 AM	21.5777444	64.6629162	40	34.25	1884.6	2	2.4	1.18	El Portillo - La Pintada vuelta
3/29/2023 7:58:27 AM	21.5775646	-64.663018	60	39.44	1884.47	-0.67	4.14	1.29	El Portillo - La Pintada vuelta
3/29/2023 7:58:29 AM	21.5773599	64.6631369	80	43.91	1883.2	-6.33	8.25	2.81	El Portillo - La Pintada vuelta
3/29/2023 7:58:30 AM	-21.577313	64.6631667	100	46.3	1882.1	-5.5	8.95	4.12	El Portillo - La Pintada vuelta
3/29/2023 7:58:31 AM	21.5772448	64.6632099	120	41.91	1881.43	-3.33	5.24	3.27	El Portillo - La Pintada vuelta
3/29/2023 7:58:33 AM	21.5769266	64.6634081	140	42.16	1881.45	0.08	5.51	3.43	El Portillo - La Pintada vuelta
3/29/2023 7:58:34 AM	21.5768443	64.6634609	160	44.77	1881.7	1.25	8.69	4.31	El Portillo - La Pintada vuelta
3/29/2023 7:58:35 AM	21.5767553	64.6635156	180	48.1	1882.37	3.33	5.24	3.27	El Portillo - La Pintada vuelta
3/29/2023 7:58:37 AM	21.5764149	64.6637337	200	54.69	1882.95	2.92	3.07	2.14	El Portillo - La Pintada vuelta
3/29/2023 7:58:38 AM	21.5763131	64.6637918	220	60.08	1882.9	-0.25	5.91	3.21	El Portillo - La Pintada vuelta
3/29/2023 7:58:39 AM	21.5762046	64.6638562	240	61.3	1883.15	1.25	8.1	4.02	El Portillo - La Pintada vuelta

Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
3/29/2023 7:58:40 AM	- 21.5760927	- -64.663923	260	62.24	1883.7	2.75	6.06	5.11	El Portillo - La Pintada vuelta
3/29/2023 7:58:41 AM	- 21.5759761	- 64.6639914	280	62.92	1884.1	2	3.76	2.24	El Portillo - La Pintada vuelta
3/29/2023 7:58:42 AM	- 21.5758571	- 64.6640669	300	64.26	1884.87	3.83	3.86	2.27	El Portillo - La Pintada vuelta
3/29/2023 7:58:44 AM	- 21.5754544	- 64.6643184	320	65.39	1885.65	3.92	4.64	2.48	El Portillo - La Pintada vuelta
3/29/2023 7:58:45 AM	- 21.5753269	- -64.664398	340	65.74	1886.2	2.75	3.53	2.54	El Portillo - La Pintada vuelta
3/29/2023 7:58:46 AM	- 21.5751958	- 64.6644805	360	66.44	1886.8	3	9.4	4.26	El Portillo - La Pintada vuelta
3/29/2023 7:58:47 AM	- 21.5750655	- 64.6645625	380	66.77	1887.3	2.5	10.89	5.15	El Portillo - La Pintada vuelta
3/29/2023 7:58:48 AM	- 21.5749315	- 64.6646453	400	67.05	1887.8	2.5	4.3	3.18	El Portillo - La Pintada vuelta
3/29/2023 7:58:49 AM	- 21.5747939	- 64.6647306	420	67.35	1888.35	2.75	7.23	4.16	El Portillo - La Pintada vuelta
3/29/2023 7:58:50 AM	- 21.5746564	- 64.6648174	440	67.42	1889.05	3.5	7.36	4.35	El Portillo - La Pintada vuelta
3/29/2023 7:58:51 AM	- -21.574519	- 64.6649043	460	67.51	1889.7	3.25	3.66	2.55	El Portillo - La Pintada vuelta
3/29/2023 7:58:52 AM	- 21.5743801	- -64.664991	480	67.95	1890.15	2.25	5.11	4.31	El Portillo - La Pintada vuelta
3/29/2023 7:58:53 AM	- 21.5742397	- 64.6650779	500	68.51	1890.8	3.25	4.67	3.23	El Portillo - La Pintada vuelta

Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
3/29/2023 7:58:54 AM	-21.574099	- 64.6651641	520	68.43	1891.45	3.25	5.22	3.21	El Portillo - La Pintada vuelta
3/29/2023 7:58:55 AM	- 21.5739576	- 64.6652518	540	68.71	1891.9	2.25	6.93	4.26	El Portillo - La Pintada vuelta
3/29/2023 7:58:56 AM	- 21.5738146	- 64.6653394	560	68.97	1892.45	2.75	6.36	4.12	El Portillo - La Pintada vuelta
3/29/2023 7:58:57 AM	- 21.5736729	- 64.6654255	580	68.7	1893.1	3.25	7.33	4.54	El Portillo - La Pintada vuelta
3/29/2023 7:58:58 AM	- 21.5735315	- 64.6655134	600	69.12	1894.1	5	5.93	3.45	El Portillo - La Pintada vuelta
3/29/2023 7:59:00 AM	- 21.5730858	- 64.6657875	620	69.33	1895.1	5	4.5	3.86	El Portillo - La Pintada vuelta
3/29/2023 7:59:01 AM	- 21.5729375	- 64.6658786	640	69.61	1895.75	3.25	5.39	4.76	El Portillo - La Pintada vuelta
3/29/2023 7:59:02 AM	- 21.5727891	- 64.6659713	660	69.78	1896.45	3.5	5.9	5.37	El Portillo - La Pintada vuelta
3/29/2023 7:59:03 AM	- 21.5726431	- 64.6660619	680	69.49	1897.3	4.25	6.64	4.65	El Portillo - La Pintada vuelta
3/29/2023 7:59:04 AM	- 21.5725013	- 64.6661509	700	69.27	1898.2	4.5	4.68	3.27	El Portillo - La Pintada vuelta
3/29/2023 7:59:05 AM	- 21.5723589	- 64.6662409	720	69.06	1899.1	4.5	3.31	2.58	El Portillo - La Pintada vuelta
3/29/2023 7:59:06 AM	- 21.5722154	- 64.6663316	740	68.78	1900.05	4.75	3.99	4.61	El Portillo - La Pintada vuelta
3/29/2023 7:59:07 AM	- 21.5720761	- 64.6664187	760	68.17	1901	4.75	3.73	2.45	El Portillo - La Pintada vuelta

Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
3/29/2023 7:59:08 AM	- 21.5719409	- -64.666504	780	67.77	1901.9	4.5	4.84	3.21	El Portillo - La Pintada vuelta
3/29/2023 7:59:09 AM	- 21.5718113	- 64.6665857	800	66.44	1902.5	3	10.29	4.65	El Portillo - La Pintada vuelta
3/29/2023 7:59:10 AM	- 21.5716881	- -64.6666663	820	63.64	1903	2.5	13.33	6.45	El Portillo - La Pintada vuelta
3/29/2023 7:59:11 AM	- 21.5715721	- 64.6667355	840	61.4	1903.6	3	10.25	5.39	El Portillo - La Pintada vuelta
3/29/2023 7:59:12 AM	- 21.5714648	- 64.6668026	860	58.8	1904.47	4.33	8.05	4.44	El Portillo - La Pintada vuelta
3/29/2023 7:59:14 AM	- 21.5711211	- 64.6670169	880	55.27	1905.2	3.67	8.91	4.63	El Portillo - La Pintada vuelta
3/29/2023 7:59:15 AM	- 21.5710442	- 64.6670647	900	52.5	1905.55	1.75	10.23	6.46	El Portillo - La Pintada vuelta
3/29/2023 7:59:16 AM	- -21.570975	- 64.6671068	920	52.18	1906.07	2.58	9.3	5.4	El Portillo - La Pintada vuelta
3/29/2023 7:59:18 AM	- 21.5706737	- 64.6672887	940	54.81	1906.35	1.42	9.81	5.43	El Portillo - La Pintada vuelta
3/29/2023 7:59:19 AM	- 21.5705887	- 64.6673403	960	56.2	1906.35	0	10.63	6.53	El Portillo - La Pintada vuelta
3/29/2023 7:59:20 AM	- 21.5705003	- 64.6673941	980	56.34	1906.37	0.08	12.96	4.22	El Portillo - La Pintada vuelta
3/29/2023 7:59:22 AM	- -21.570171	- 64.6676001	1000	56.07	1906.3	-0.33	9.85	5.65	El Portillo - La Pintada vuelta
3/29/2023 7:59:23 AM	- 21.5700869	- 64.6676527	1020	55.88	1906.1	-1	10.03	6.52	El Portillo - La Pintada vuelta



Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
3/29/2023 7:59:24 AM	- 21.5700051	- 64.6677036	1040	54.29	1905.9	-1	11.92	5.45	El Portillo - La Pintada vuelta
3/29/2023 7:59:26 AM	- 21.5697007	- 64.6678897	1060	49.92	1905.75	-0.75	10.28	5.55	El Portillo - La Pintada vuelta
3/29/2023 7:59:27 AM	- 21.5696505	- 64.6679166	1080	39.64	1905.47	-1.42	6.4	4.76	El Portillo - La Pintada vuelta

### Depuración de datos

MEDIA

$$\bar{X} = \frac{\sum_{j=1}^n X_j}{n} = \frac{X_1 + X_2 + \dots + X_n}{n} = 3.978$$

VARIANZA

$$\sigma^2 = \frac{\sum_{j=1}^n (X_j - \mu)^2}{N} = \overline{(x - \mu)^2} = 1.971$$

DESVIACIÓN ESTANDAR

$$\sigma = \sqrt{\frac{\sum_{j=1}^n (X_j - \mu)^2}{N}} = \sqrt{\overline{(x - \mu)^2}} = 1.404$$

RANGO

$$(\bar{x} \pm \sigma) = (2.574 - 5.382)$$

Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
3/29/2023 7:58:29 AM	- 21.5773599	- 64.6631369	80	43.91	1883.2	-6.33	8.25	2.81	El Portillo - La Pintada vuelta
3/29/2023 7:58:30 AM	- -21.577313	- 64.6631667	100	46.3	1882.1	-5.5	8.95	4.12	El Portillo - La Pintada vuelta
3/29/2023 7:58:31 AM	- 21.5772448	- 64.6632099	120	41.91	1881.43	-3.33	5.24	3.27	El Portillo - La Pintada vuelta
3/29/2023 7:58:33 AM	- 21.5769266	- 64.6634081	140	42.16	1881.45	0.08	5.51	3.43	El Portillo - La Pintada vuelta
3/29/2023 7:58:34 AM	- 21.5768443	- 64.6634609	160	44.77	1881.7	1.25	8.69	4.31	El Portillo - La Pintada vuelta
3/29/2023 7:58:35 AM	- 21.5767553	- 64.6635156	180	48.1	1882.37	3.33	5.24	3.27	El Portillo - La Pintada vuelta
3/29/2023 7:58:38 AM	- 21.5763131	- 64.6637918	220	60.08	1882.9	-0.25	5.91	3.21	El Portillo - La Pintada vuelta
3/29/2023 7:58:39 AM	- 21.5762046	- 64.6638562	240	61.3	1883.15	1.25	8.1	4.02	El Portillo - La Pintada vuelta
3/29/2023 7:58:40 AM	- 21.5760927	- -64.663923	260	62.24	1883.7	2.75	6.06	5.11	El Portillo - La Pintada vuelta
3/29/2023 7:58:46 AM	- -21.5751958	- -64.6644805	360	66.44	1886.8	3	9.4	4.26	El Portillo - La Pintada vuelta
3/29/2023 7:58:47 AM	- -21.5750655	- -64.6645625	380	66.77	1887.3	2.5	10.89	5.15	El Portillo - La Pintada vuelta
3/29/2023 7:58:48 AM	- -21.5749315	- -64.6646453	400	67.05	1887.8	2.5	4.3	3.18	El Portillo - La Pintada vuelta
3/29/2023 7:58:49 AM	- -21.5747939	- -64.6647306	420	67.35	1888.35	2.75	7.23	4.16	El Portillo - La Pintada vuelta
3/29/2023 7:58:50 AM	- -21.5746564	- -64.6648174	440	67.42	1889.05	3.5	7.36	4.35	El Portillo - La Pintada vuelta

DateTime	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
3/29/2023 7:58:52 AM	- 21.5743801	- -64.664991	480	67.95	1890.15	2.25	5.11	4.31	El Portillo – La Pintada vuelta
3/29/2023 7:58:53 AM	- 21.5742397	- 64.6650779	500	68.51	1890.8	3.25	4.67	3.23	El Portillo – La Pintada vuelta
3/29/2023 7:58:54 AM	- -21.574099	- 64.6651641	520	68.43	1891.45	3.25	5.22	3.21	El Portillo – La Pintada vuelta
3/29/2023 7:58:55 AM	- 21.5739576	- 64.6652518	540	68.71	1891.9	2.25	6.93	4.26	El Portillo – La Pintada vuelta
3/29/2023 7:58:56 AM	- 21.5738146	- 64.6653394	560	68.97	1892.45	2.75	6.36	4.12	El Portillo – La Pintada vuelta
3/29/2023 7:58:57 AM	- 21.5736729	- 64.6654255	580	68.7	1893.1	3.25	7.33	4.54	El Portillo – La Pintada vuelta
3/29/2023 7:58:58 AM	- 21.5735315	- 64.6655134	600	69.12	1894.1	5	5.93	3.45	El Portillo – La Pintada vuelta
3/29/2023 7:59:00 AM	- 21.5730858	- 64.6657875	620	69.33	1895.1	5	4.5	3.86	El Portillo – La Pintada vuelta
3/29/2023 7:59:01 AM	- 21.5729375	- 64.6658786	640	69.61	1895.75	3.25	5.39	4.76	El Portillo – La Pintada vuelta
3/29/2023 7:59:03 AM	- 21.5726431	- 64.6660619	680	69.49	1897.3	4.25	6.64	4.65	El Portillo – La Pintada vuelta
3/29/2023 7:59:04 AM	- 21.5725013	- 64.6661509	700	69.27	1898.2	4.5	4.68	3.27	El Portillo – La Pintada vuelta
3/29/2023 7:59:05 AM	- 21.5723589	- 64.6662409	720	69.06	1899.1	4.5	3.31	2.58	El Portillo – La Pintada vuelta
3/29/2023 7:59:06 AM	- 21.5722154	- 64.6663316	740	68.78	1900.05	4.75	3.99	4.61	El Portillo – La Pintada vuelta

Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
3/29/2023 7:59:08 AM	- 21.5719409	- -64.666504	780	67.77	1901.9	4.5	4.84	3.21	El Portillo - La Pintada vuelta
3/29/2023 7:59:09 AM	- 21.5718113	- 64.6665857	800	66.44	1902.5	3	10.29	4.65	El Portillo - La Pintada vuelta
3/29/2023 7:59:12 AM	- 21.5714648	- 64.6668026	860	58.8	1904.47	4.33	8.05	4.44	El Portillo - La Pintada vuelta
3/29/2023 7:59:14 AM	- 21.5711211	- 64.6670169	880	55.27	1905.2	3.67	8.91	4.63	El Portillo - La Pintada vuelta
3/29/2023 7:59:20 AM	- 21.5705003	- 64.6673941	980	56.34	1906.37	0.08	12.96	4.22	El Portillo - La Pintada vuelta
3/29/2023 7:59:27 AM	- 21.5696505	- 64.6679166	1080	39.64	1905.47	-1.42	6.4	4.76	El Portillo - La Pintada vuelta

**Nombre del tramo:** Carretera San Mateo – Sella (Monte Méndez - Barrio El Taco)

**Carril de ida**

Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
03/12/2023 13:07	-21.71908	- 64.612122	20	60.25	1761	0	1.58	1.7	San Mateo - Sella ida
03/12/2023 13:07	- 21.718839	- -64.61197	40	61.84	1760.95	-0.25	4.88	1.39	San Mateo - Sella ida
03/12/2023 13:07	- 21.718729	- 64.611898	60	62.26	1760.85	-0.5	3.13	3.27	San Mateo - Sella ida
03/12/2023 13:07	- 21.718621	- 64.611825	80	63.63	1760.9	0.25	1.93	3.14	San Mateo - Sella ida
03/12/2023 13:07	- 21.718504	- 64.611745	100	61.27	1760.85	-0.25	1.81	2.19	San Mateo - Sella ida
03/12/2023 13:07	- -21.71836	- 64.611655	120	58.87	1760.7	-0.75	2.92	2.23	San Mateo - Sella ida
03/12/2023 13:07	- 21.718197	- 64.611558	140	61.45	1760.25	-2.25	4.2	2.15	San Mateo - Sella ida
03/12/2023 13:07	- 21.718025	- 64.611461	160	68.9	1759.65	-3	3.27	2.28	San Mateo - Sella ida
03/12/2023 13:07	- 21.717853	- 64.611361	180	75.52	1759.1	-2.75	2.23	2.42	San Mateo - Sella ida
03/12/2023 13:07	- 21.717678	- 64.611257	200	76.89	1758.3	-4	4.34	3.22	San Mateo - Sella ida
03/12/2023 13:07	- 21.717494	- 64.611147	220	77.69	1757.4	-4.5	4.91	3.07	San Mateo - Sella ida
03/12/2023 13:08	- 21.717308	- 64.611035	240	78.06	1756.7	-3.5	3.85	3.22	San Mateo - Sella ida

Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
03/12/2023 13:08	-21.71712	64.610923	260	79.25	1756.2	-2.5	3.32	2.78	San Mateo - Sella ida
03/12/2023 13:08	-21.716924	64.610808	280	80.84	1756	-1	4.03	2.27	San Mateo - Sella ida
03/12/2023 13:08	-21.716727	64.610688	300	80.84	1756	0	4.03	3.13	San Mateo - Sella ida
03/12/2023 13:08	-21.716722	64.610685	320	81	1755.7	-1.5	4.22	3.92	San Mateo - Sella ida
03/12/2023 13:08	-21.716692	64.610666	340	79.1	1755.1	-3	4.3	2.68	San Mateo - Sella ida
03/12/2023 13:08	-21.716506	64.610551	360	77.44	1754.45	-3.25	4.39	2.73	San Mateo - Sella ida
03/12/2023 13:08	-21.716324	64.610438	380	77.03	1753.95	-2.5	2.59	2.7	San Mateo - Sella ida
03/12/2023 13:08	-21.716144	64.610326	400	77.85	1753.6	-1.75	2.44	2.51	San Mateo - Sella ida
03/12/2023 13:08	-21.715958	-64.61021	420	79.08	1753.25	-1.75	2.34	2.76	San Mateo - Sella ida
03/12/2023 13:08	-21.715768	64.610093	440	79.82	1752.75	-2.5	3.13	2.88	San Mateo - Sella ida
03/12/2023 13:08	-21.715574	64.609973	460	80.44	1751.9	-4.25	3.14	3.34	San Mateo - Sella ida
03/12/2023 13:08	-21.715376	64.609851	480	81.14	1751.05	-4.25	2.44	2.14	San Mateo - Sella ida

Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
03/12/2023 13:08	- 21.715176	- 64.609729	500	81.14	1751.05	0	2.44	3.06	San Mateo - Sella ida
03/12/2023 13:08	- 21.715172	- 64.609727	520	81.94	1750.3	-3.75	2.48	2.66	San Mateo - Sella ida
03/12/2023 13:08	- 21.715133	- 64.609703	540	82.18	1749.55	-3.75	3.57	2.85	San Mateo - Sella ida
03/12/2023 13:08	- 21.714934	- 64.609581	560	82	1749.05	-2.5	3.99	3.23	San Mateo - Sella ida
03/12/2023 13:08	- 21.714738	- 64.609455	580	81.19	1748.8	-1.25	4.51	2.01	San Mateo - Sella ida
03/12/2023 13:08	- -21.71455	- 64.609328	600	80.83	1748.8	0	3.99	2.46	San Mateo - Sella ida
03/12/2023 13:08	- 21.714376	- 64.609206	620	81.07	1749.1	1.5	2.23	3.19	San Mateo - Sella ida
03/12/2023 13:08	- 21.714209	- -64.60908	640	80.65	1749.5	2	2.84	3.73	San Mateo - Sella ida
03/12/2023 13:08	- -21.71404	- 64.608939	660	80.01	1749.8	1.5	2.75	3.08	San Mateo - Sella ida
03/12/2023 13:08	- 21.713877	- 64.608789	680	79.64	1750.1	1.5	3.53	3.43	San Mateo - Sella ida
03/12/2023 13:08	- 21.713726	- 64.608632	700	79.62	1750.3	1	4.44	3.15	San Mateo - Sella ida
03/12/2023 13:08	- 21.713586	- 64.608469	720	78.27	1750.2	-0.5	3.27	2.83	San Mateo - Sella ida

Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
03/12/2023 13:08	- 21.713453	- 64.608298	740	78.27	1750.2	0	3.27	2.83	San Mateo - Sella ida
03/12/2023 13:08	- 21.713453	- 64.608298	760	76.78	1749.9	-1.5	2.23	2.84	San Mateo - Sella ida
03/12/2023 13:08	- 21.713436	- 64.608275	780	76.79	1749.35	-2.75	3.32	3.16	San Mateo - Sella ida
03/12/2023 13:08	- 21.713304	- 64.608099	800	78.12	1748.65	-3.5	4.63	3.79	San Mateo - Sella ida
03/12/2023 13:08	- 21.713165	- 64.607924	820	78.95	1747.9	-3.75	3.91	3.45	San Mateo - Sella ida
03/12/2023 13:08	- 21.713013	- 64.607752	840	79.16	1747.05	-4.25	2.95	2.48	San Mateo - Sella ida
03/12/2023 13:08	- 21.712853	- 64.607584	860	80.33	1746.1	-4.75	2.47	2.18	San Mateo - Sella ida
03/12/2023 13:08	- -21.71268	- 64.607421	880	81.9	1745	-5.5	4.21	3.26	San Mateo - Sella ida
03/12/2023 13:08	- 21.712493	- 64.607266	900	82.76	1743.9	-5.5	5.63	3.48	San Mateo - Sella ida
03/12/2023 13:08	- 21.712295	- 64.607124	920	82.76	1743.9	0	5.63	3.48	San Mateo - Sella ida
03/12/2023 13:08	- -21.71229	- -64.60712	940	82.72	1742.8	-5.5	4.78	2.94	San Mateo - Sella ida
03/12/2023 13:08	- 21.712246	- 64.607093	960	82.72	1741.45	-6.75	4.85	3.11	San Mateo - Sella ida



Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
03/12/2023 13:08	- 21.712041	- 64.606973	980	83.23	1739.85	-8	5.71	3.18	San Mateo - Sella ida
03/12/2023 13:08	- 21.711828	- 64.60687	1000	83.41	1738.25	-8	4.92	2.78	San Mateo - Sella ida
03/12/2023 13:08	- 21.711607	- 64.606781	1020	83.14	1736.7	-7.75	3.12	2.88	San Mateo - Sella ida
03/12/2023 13:08	- 21.711381	- 64.606702	1040	83.96	1735.1	-8	3.07	3.88	San Mateo - Sella ida
03/12/2023 13:08	- 21.711145	- 64.606627	1060	83.96	1735.1	0	3.07	2.88	San Mateo - Sella ida
03/12/2023 13:08	- 21.711142	- 64.606626	1080	84.73	1733.55	-7.75	5.91	3.43	San Mateo - Sella ida
03/12/2023 13:08	- 21.711083	- 64.606609	1100	84.42	1732.2	-6.75	5.38	3.13	San Mateo - Sella ida
03/12/2023 13:08	- -21.71085	- 64.606544	1120	84.28	1731.15	-5.25	2.25	2.08	San Mateo - Sella ida
03/12/2023 13:08	- 21.710622	- 64.606478	1140	82.76	1730.25	-4.5	2.03	1.87	San Mateo - Sella ida
03/12/2023 13:08	- 21.710407	- 64.606412	1160	79.04	1729.4	-4.25	2.04	2.21	San Mateo - Sella ida
03/12/2023 13:08	- 21.710204	- 64.606343	1180	76.51	1728.65	-3.75	2.16	2.33	San Mateo - Sella ida
03/12/2023 13:08	- 21.710014	- 64.606274	1200	74.81	1728.05	-3	2.12	2.39	San Mateo - Sella ida

Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
03/12/2023 13:08	- 21.709837	- 64.606203	1220	72.04	1727.75	-1.5	2.62	2.35	San Mateo - Sella ida
03/12/2023 13:08	- 21.709677	- 64.606128	1240	69.85	1727.55	-1	2.86	2.38	San Mateo - Sella ida
03/12/2023 13:08	- 21.709534	- 64.606051	1260	68.36	1727.25	-1.5	2.29	2.14	San Mateo - Sella ida
03/12/2023 13:08	- 21.709397	- 64.605967	1280	68.37	1726.9	-1.75	1.93	2.49	San Mateo - Sella ida
03/12/2023 13:08	- 21.709257	- 64.605874	1300	69.99	1726.45	-2.25	2.6	2.58	San Mateo - Sella ida
03/12/2023 13:08	- 21.709119	- 64.605769	1320	70.78	1725.95	-2.5	4.81	2.2	San Mateo - Sella ida
03/12/2023 13:08	- 21.708987	- 64.605649	1340	70.79	1725.55	-2	5.44	2.21	San Mateo - Sella ida
03/12/2023 13:08	- 21.708861	- 64.605524	1360	71	1725.2	-1.75	5.3	2.24	San Mateo - Sella ida
03/12/2023 13:08	- 21.708742	- 64.605393	1380	70.59	1724.7	-2.5	3.93	2.98	San Mateo - Sella ida
03/12/2023 13:08	- 21.708625	- 64.605259	1400	70.03	1724.25	-2.25	2.05	2.79	San Mateo - Sella ida
03/12/2023 13:08	- 21.708506	- 64.605121	1420	70.87	1724	-1.25	13.73	2.16	San Mateo - Sella ida
03/12/2023 13:08	- 21.708393	- 64.604977	1440	70.51	1723.55	-2.25	20.19	3.41	San Mateo - Sella ida

Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
03/12/2023 13:08	- 21.708292	- 64.604832	1460	68.95	1722.85	-3.5	20.54	2.22	San Mateo - Sella ida

Depuración de datos

MEDIA

$$\bar{X} = \frac{\sum_{j=1}^n X_j}{n} = \frac{X_1 + X_2 + \dots + X_n}{n} = 2.767$$

VARIANZA

$$\sigma^2 = \frac{\sum_{j=1}^n (X_j - \mu)^2}{N} = \overline{(x - \mu)^2} = 0.290$$

DESVIACIÓN ESTANDAR

$$\sigma = \sqrt{\frac{\sum_{j=1}^n (X_j - \mu)^2}{N}} = \sqrt{\overline{(x - \mu)^2}} = 0.539$$

RANGO

$$(\bar{x} \pm \sigma) = (2.228 - 3.306)$$

Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
03/12/2023 13:07	- 21.71872874	- 64.611898	60	62.26	1760.85	-0.5	3.13	3.27	San Mateo - Sella ida
03/12/2023 13:07	- 21.71862129	- 64.611825	80	63.63	1760.9	0.25	1.93	3.14	San Mateo - Sella ida
03/12/2023 13:07	- 21.71835982	- 64.611655	120	58.87	1760.7	-0.75	2.92	2.23	San Mateo - Sella ida
03/12/2023 13:07	- -21.7180245	- 64.611461	160	68.9	1759.65	-3	3.27	2.28	San Mateo - Sella ida
03/12/2023 13:07	- 21.71785281	- 64.611361	180	75.52	1759.1	-2.75	2.23	2.42	San Mateo - Sella ida
03/12/2023 13:07	- 21.71767773	- 64.611257	200	76.89	1758.3	-4	4.34	3.22	San Mateo - Sella ida
03/12/2023 13:07	- -21.7174937	- 64.611147	220	77.69	1757.4	-4.5	4.91	3.07	San Mateo - Sella ida
03/12/2023 13:08	- -21.7173081	- 64.611035	240	78.06	1756.7	-3.5	3.85	3.22	San Mateo - Sella ida
03/12/2023 13:08	- 21.71711951	- 64.610923	260	79.25	1756.2	-2.5	3.32	2.78	San Mateo - Sella ida
03/12/2023 13:08	- -21.7169238	- 64.610808	280	80.84	1756	-1	4.03	2.27	San Mateo - Sella ida
03/12/2023 13:08	- 21.71672708	- 64.610688	300	80.84	1756	0	4.03	3.13	San Mateo - Sella ida
03/12/2023 13:08	- 21.71669197	- 64.610666	340	79.1	1755.1	-3	4.3	2.68	San Mateo - Sella ida
03/12/2023 13:08	- 21.71650636	- 64.610551	360	77.44	1754.45	-3.25	4.39	2.73	San Mateo - Sella ida
03/12/2023 13:08	- 21.71632445	- 64.610438	380	77.03	1753.95	-2.5	2.59	2.7	San Mateo - Sella ida

Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
03/12/2023 13:08	- 21.71614358	- 64.610326	400	77.85	1753.6	-1.75	2.44	2.51	San Mateo - Sella ida
03/12/2023 13:08	- 21.71595789	- -64.61021	420	79.08	1753.25	-1.75	2.34	2.76	San Mateo - Sella ida
03/12/2023 13:08	- -21.7157681	- 64.610093	440	79.82	1752.75	-2.5	3.13	2.88	San Mateo - Sella ida
03/12/2023 13:08	- 21.71517573	- 64.609729	500	81.14	1751.05	0	2.44	3.06	San Mateo - Sella ida
03/12/2023 13:08	- 21.71517228	- 64.609727	520	81.94	1750.3	-3.75	2.48	2.66	San Mateo - Sella ida
03/12/2023 13:08	- 21.71513284	- 64.609703	540	82.18	1749.55	-3.75	3.57	2.85	San Mateo - Sella ida
03/12/2023 13:08	- 21.71493359	- 64.609581	560	82	1749.05	-2.5	3.99	3.23	San Mateo - Sella ida
03/12/2023 13:08	- 21.71455018	- 64.609328	600	80.83	1748.8	0	3.99	2.46	San Mateo - Sella ida
03/12/2023 13:08	- 21.71437626	- 64.609206	620	81.07	1749.1	1.5	2.23	3.19	San Mateo - Sella ida
03/12/2023 13:08	- 21.71403987	- 64.608939	660	80.01	1749.8	1.5	2.75	3.08	San Mateo - Sella ida
03/12/2023 13:08	- 21.71372603	- 64.608632	700	79.62	1750.3	1	4.44	3.15	San Mateo - Sella ida
03/12/2023 13:08	- 21.71358593	- 64.608469	720	78.27	1750.2	-0.5	3.27	2.83	San Mateo - Sella ida
03/12/2023 13:08	- 21.71345301	- 64.608298	740	78.27	1750.2	0	3.27	2.83	San Mateo - Sella ida

Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
03/12/2023 13:08	-21.713453	64.608298	760	76.78	1749.9	-1.5	2.23	2.84	San Mateo - Sella ida
03/12/2023 13:08	-21.7134359	64.608275	780	76.79	1749.35	-2.75	3.32	3.16	San Mateo - Sella ida
03/12/2023 13:08	- 21.71301315	- 64.607752	840	79.16	1747.05	-4.25	2.95	2.48	San Mateo - Sella ida
03/12/2023 13:08	- 21.71268007	- 64.607421	880	81.9	1745	-5.5	4.21	3.26	San Mateo - Sella ida
03/12/2023 13:08	- 21.71228963	- -64.60712	940	82.72	1742.8	-5.5	4.78	2.94	San Mateo - Sella ida
03/12/2023 13:08	- 21.71224637	- 64.607093	960	82.72	1741.45	-6.75	4.85	3.11	San Mateo - Sella ida
03/12/2023 13:08	- 21.71204078	- 64.606973	980	83.23	1739.85	-8	5.71	3.18	San Mateo - Sella ida
03/12/2023 13:08	- 21.71182841	- -64.60687	1000	83.41	1738.25	-8	4.92	2.78	San Mateo - Sella ida
03/12/2023 13:08	- 21.71160739	- 64.606781	1020	83.14	1736.7	-7.75	3.12	2.88	San Mateo - Sella ida
03/12/2023 13:08	- 21.71114504	- 64.606627	1060	83.96	1735.1	0	3.07	2.88	San Mateo - Sella ida
03/12/2023 13:08	- 21.71108345	- 64.606609	1100	84.42	1732.2	-6.75	5.38	3.13	San Mateo - Sella ida
03/12/2023 13:08	- 21.71020406	- 64.606343	1180	76.51	1728.65	-3.75	2.16	2.33	San Mateo - Sella ida
03/12/2023 13:08	- 21.71001433	- 64.606274	1200	74.81	1728.05	-3	2.12	2.39	San Mateo - Sella ida

Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
03/12/2023 13:08	- 21.70983745	- 64.606203	1220	72.04	1727.75	-1.5	2.62	2.35	San Mateo - Sella ida
03/12/2023 13:08	-21.7096775	- 64.606128	1240	69.85	1727.55	-1	2.86	2.38	San Mateo - Sella ida
03/12/2023 13:08	- 21.70939726	- 64.605967	1280	68.37	1726.9	-1.75	1.93	2.49	San Mateo - Sella ida
03/12/2023 13:08	- 21.70925689	- 64.605874	1300	69.99	1726.45	-2.25	2.6	2.58	San Mateo - Sella ida
03/12/2023 13:08	- 21.70886141	- 64.605524	1360	71	1725.2	-1.75	5.3	2.24	San Mateo - Sella ida
03/12/2023 13:08	- 21.70874182	- 64.605393	1380	70.59	1724.7	-2.5	3.93	2.98	San Mateo - Sella ida
03/12/2023 13:08	- 21.70862454	- 64.605259	1400	70.03	1724.25	-2.25	2.05	2.79	San Mateo - Sella ida
03/12/2023 13:08	-21.7082915	- 64.604832	1460	68.95	1722.85	-3.5	20.54	2.22	San Mateo - Sella ida

**Nombre del tramo:** Carretera San Mateo – Sella (Monte Méndez - Barrio El Taco)

**Carril de vuelta**

Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
3/21/2023 13:26:48	- 21.715235	-64.6097	20	26.54	1745.93	0	5.9	0.47	San Mateo – Sella vuelta

Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
3/21/2023 13:26:50	- 21.715067	- 64.609606	40	34.07	1745.23	-3.5	6.17	1.72	San Mateo - Sella vuelta
3/21/2023 13:26:52	- 21.714907	- 64.609509	60	38.26	1744.37	-4.33	4.7	3.8	San Mateo - Sella vuelta
3/21/2023 13:26:54	- 21.714718	- -64.60939	80	42.26	1744.15	-1.08	1.92	4.12	San Mateo - Sella vuelta
3/21/2023 13:26:55	- 21.714688	- 64.609372	100	45.28	1744.17	0.08	2.11	3.72	San Mateo - Sella vuelta
3/21/2023 13:26:57	- 21.714451	- 64.609217	120	47.72	1744.45	1.42	1.54	2.6	San Mateo - Sella vuelta
3/21/2023 13:26:58	- 21.714395	- 64.609177	140	49.22	1744.77	1.58	1.85	2.91	San Mateo - Sella vuelta
3/21/2023 13:27:00	- 21.714121	- 64.608973	160	49.83	1744.75	-0.08	4.49	2.57	San Mateo - Sella vuelta
3/21/2023 13:27:01	- 21.714065	- 64.608927	180	50.73	1744.73	-0.08	3.8	3.47	San Mateo - Sella vuelta
3/21/2023 13:27:03	- 21.713815	- 64.608681	200	53.4	1744.7	-0.17	2.28	3.36	San Mateo - Sella vuelta
3/21/2023 13:27:04	- -21.71375	- 64.608608	220	55.36	1744.6	-0.5	2.46	2.8	San Mateo - Sella vuelta
3/21/2023 13:27:05	- -21.71368	- 64.608528	240	57.26	1744.27	-1.67	2.99	3.05	San Mateo - Sella vuelta
3/21/2023 13:27:07	- 21.713423	- 64.608206	260	58.51	1743.8	-2.33	3.5	3.42	San Mateo - Sella vuelta
3/21/2023 13:27:08	- 21.713351	- 64.608116	280	58.95	1743.15	-3.25	2.43	3.68	San Mateo - Sella vuelta



Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
3/21/2023 13:27:09	- 21.713279	- 64.608025	300	59.15	1742.25	-4.5	4.89	3.19	San Mateo - Sella vuelta
3/21/2023 13:27:10	- 21.713202	- 64.607932	320	59.98	1741.35	-4.5	4.97	2.71	San Mateo - Sella vuelta
3/21/2023 13:27:11	- 21.713119	- 64.607835	340	61.9	1739.9	-7.25	2.81	2.69	San Mateo - Sella vuelta
3/21/2023 13:27:13	- 21.712801	- 64.607501	360	63.8	1738.25	-8.25	2.18	2.7	San Mateo - Sella vuelta
3/21/2023 13:27:14	- 21.712693	- 64.607401	380	64.66	1737.25	-5	3.41	2.72	San Mateo - Sella vuelta
3/21/2023 13:27:15	- 21.712578	- 64.607303	400	65.14	1736.3	-4.75	3.59	3.15	San Mateo - Sella vuelta
3/21/2023 13:27:16	- 21.712458	-64.60721	420	65.41	1735.25	-5.25	2.14	3.57	San Mateo - Sella vuelta
3/21/2023 13:27:17	- 21.712333	- 64.607123	440	65.28	1734.2	-5.25	1.85	3.44	San Mateo - Sella vuelta
3/21/2023 13:27:18	- 21.712203	- 64.607042	460	65.45	1733.3	-4.5	1.75	3.31	San Mateo - Sella vuelta
3/21/2023 13:27:19	-21.71207	- 64.606968	480	65.59	1732.55	-3.75	1.83	2.92	San Mateo - Sella vuelta
3/21/2023 13:27:20	- 21.711929	-64.6069	500	65.97	1731.7	-4.25	1.81	2.53	San Mateo - Sella vuelta
3/21/2023 13:27:21	-21.71178	- 64.606839	520	66.75	1730.85	-4.25	1.6	2.28	San Mateo - Sella vuelta
3/21/2023 13:27:22	- 21.711628	- 64.606782	540	67.35	1730.05	-4	1.47	2.03	San Mateo - Sella vuelta

Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
3/21/2023 13:27:23	- 21.711476	- -64.60673	560	67.59	1729.2	-4.25	1.7	1.76	San Mateo - Sella vuelta
3/21/2023 13:27:24	- -21.71132	- 64.606681	580	67.1	1728.27	-4.67	1.75	2.6	San Mateo - Sella vuelta
3/21/2023 13:27:25	- 21.710847	- 64.606544	600	66.82	1727.5	-3.83	1.52	1.89	San Mateo - Sella vuelta
3/21/2023 13:27:26	- 21.710698	- 64.606502	620	66.8	1727.1	-2	1.66	1.9	San Mateo - Sella vuelta
3/21/2023 13:27:27	- 21.710552	- 64.606461	640	65.93	1726.9	-1	1.7	1.91	San Mateo - Sella vuelta
3/21/2023 13:27:28	- 21.710414	- 64.606422	660	65.46	1726.9	0	1.65	1.74	San Mateo - Sella vuelta
3/21/2023 13:27:29	- 21.710283	- 64.606385	680	64.21	1727.05	0.75	1.53	1.57	San Mateo - Sella vuelta
3/21/2023 13:27:30	- 21.710159	- 64.606347	700	63.18	1727.5	2.25	1.3	1.59	San Mateo - Sella vuelta
3/21/2023 13:27:31	- 21.710043	- 64.606309	720	60.19	1727.93	2.17	1.49	1.71	San Mateo - Sella vuelta
3/21/2023 13:27:32	- 21.709669	- 64.606149	740	57.78	1728.3	1.83	1.56	3.91	San Mateo - Sella vuelta
3/21/2023 13:27:33	- 21.709575	- 64.606096	760	57.27	1728.45	0.75	1.47	2.11	San Mateo - Sella vuelta
3/21/2023 13:27:34	- 21.709485	- 64.606041	780	57.49	1728.45	0	1.54	2.31	San Mateo - Sella vuelta
3/21/2023 13:27:35	- 21.709396	- 64.605982	800	57.06	1727.87	-2.92	1.65	2.05	San Mateo - Sella vuelta

Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
3/21/2023 13:27:36	- 21.709084	- 64.605732	820	57.13	1726.7	-5.83	1.54	1.85	San Mateo - Sella vuelta
3/21/2023 13:27:37	- 21.709003	- 64.605655	840	57.68	1725.55	-5.75	1.55	1.77	San Mateo - Sella vuelta
3/21/2023 13:27:38	- 21.708922	- 64.605574	860	58.08	1724.25	-6.5	1.61	2.52	San Mateo - Sella vuelta
3/21/2023 13:27:39	- 21.708844	- 64.605491	880	57.37	1722.27	-9.92	1.5	2.43	San Mateo - Sella vuelta
3/21/2023 13:27:40	- 21.708584	- 64.605175	900	57.32	1720.65	-8.08	1.4	2.03	San Mateo - Sella vuelta
3/21/2023 13:27:41	- 21.708519	- 64.605082	920	57.72	1719.85	-4	1.23	1.58	San Mateo - Sella vuelta
3/21/2023 13:27:42	- 21.708456	- 64.604985	940	57.91	1719.15	-3.5	4.41	2.93	San Mateo - Sella vuelta
3/21/2023 13:27:43	- 21.708393	- 64.604886	960	55.43	1718.17	-4.92	14.53	3.25	San Mateo - Sella vuelta
3/21/2023 13:27:44	- 21.708188	- -64.60456	980	53	1717.15	-5.08	17.09	6.29	San Mateo - Sella vuelta
3/21/2023 13:27:45	- 21.708143	- 64.604488	1000	49.65	1716.23	-4.58	15.38	7.32	San Mateo - Sella vuelta
3/21/2023 13:27:46	- -21.70798	- -64.60422	1020	44.67	1715.5	-3.67	12.16	5.43	San Mateo - Sella vuelta

Depuración de datos

MEDIA

$$\bar{X} = \frac{\sum_{j=1}^n X_j}{n} = \frac{X_1 + X_2 + \dots + X_n}{n} = 2.802$$

VARIANZA

$$\sigma^2 = \frac{\sum_{j=1}^n (X_j - \mu)^2}{N} = \overline{(x - \mu)^2} = 1.317$$

DESVIACIÓN ESTANDAR

$$\sigma = \sqrt{\frac{\sum_{j=1}^n (X_j - \mu)^2}{N}} = \sqrt{\overline{(x - \mu)^2}} = 1.148$$

RANGO

$$(\bar{x} \pm \sigma) = (1.654 - 3.950)$$

Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
3/21/2023 13:26:50	- 21.715067	- 64.609606	40	34.07	1745.23	-3.5	6.17	1.72	San Mateo - Sella vuelta
3/21/2023 13:26:52	- 21.714907	- 64.609509	60	38.26	1744.37	-4.33	4.7	3.8	San Mateo - Sella vuelta
3/21/2023 13:26:54	- 21.714688	- 64.609372	100	45.28	1744.17	0.08	2.11	3.72	San Mateo - Sella vuelta
3/21/2023 13:26:55	- 21.714451	- 64.609217	120	47.72	1744.45	1.42	1.54	2.6	San Mateo - Sella vuelta

Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
3/21/2023 13:26:57	- 21.714395	- 64.609177	140	49.22	1744.77	1.58	1.85	2.91	San Mateo - Sella vuelta
3/21/2023 13:26:58	- 21.714121	- 64.608973	160	49.83	1744.75	-0.08	4.49	2.57	San Mateo - Sella vuelta
3/21/2023 13:27:00	- 21.714065	- 64.608927	180	50.73	1744.73	-0.08	3.8	3.47	San Mateo - Sella vuelta
3/21/2023 13:27:01	- 21.713815	- 64.608681	200	53.4	1744.7	-0.17	2.28	3.36	San Mateo - Sella vuelta
3/21/2023 13:27:03	- -21.71375	- 64.608608	220	55.36	1744.6	-0.5	2.46	2.8	San Mateo - Sella vuelta
3/21/2023 13:27:04	- -21.71368	- 64.608528	240	57.26	1744.27	-1.67	2.99	3.05	San Mateo - Sella vuelta
3/21/2023 13:27:05	- 21.713423	- 64.608206	260	58.51	1743.8	-2.33	3.5	3.42	San Mateo - Sella vuelta
3/21/2023 13:27:07	- 21.713351	- 64.608116	280	58.95	1743.15	-3.25	2.43	3.68	San Mateo - Sella vuelta
3/21/2023 13:27:08	- 21.713279	- 64.608025	300	59.15	1742.25	-4.5	4.89	3.19	San Mateo - Sella vuelta
3/21/2023 13:27:09	- 21.713202	- 64.607932	320	59.98	1741.35	-4.5	4.97	2.71	San Mateo - Sella vuelta
3/21/2023 13:27:10	- 21.713119	- 64.607835	340	61.9	1739.9	-7.25	2.81	2.69	San Mateo - Sella vuelta
3/21/2023 13:27:11	- 21.712801	- 64.607501	360	63.8	1738.25	-8.25	2.18	2.7	San Mateo - Sella vuelta
3/21/2023 13:27:13	- 21.712693	- 64.607401	380	64.66	1737.25	-5	3.41	2.72	San Mateo - Sella vuelta

Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
3/21/2023 13:27:14	- 21.712578	- 64.607303	400	65.14	1736.3	-4.75	3.59	3.15	San Mateo - Sella vuelta
3/21/2023 13:27:15	- 21.712458	- 64.60721	420	65.41	1735.25	-5.25	2.14	3.57	San Mateo - Sella vuelta
3/21/2023 13:27:16	- 21.712333	- 64.607123	440	65.28	1734.2	-5.25	1.85	3.44	San Mateo - Sella vuelta
3/21/2023 13:27:17	- 21.712203	- 64.607042	460	65.45	1733.3	-4.5	1.75	3.31	San Mateo - Sella vuelta
3/21/2023 13:27:18	- -21.71207	- 64.606968	480	65.59	1732.55	-3.75	1.83	2.92	San Mateo - Sella vuelta
3/21/2023 13:27:19	- 21.711929	- 64.6069	500	65.97	1731.7	-4.25	1.81	2.53	San Mateo - Sella vuelta
3/21/2023 13:27:20	- -21.71178	- 64.606839	520	66.75	1730.85	-4.25	1.6	2.28	San Mateo - Sella vuelta
3/21/2023 13:27:21	- 21.711628	- 64.606782	540	67.35	1730.05	-4	1.47	2.03	San Mateo - Sella vuelta
3/21/2023 13:27:22	- 21.711476	- 64.60673	560	67.59	1729.2	-4.25	1.7	1.76	San Mateo - Sella vuelta
3/21/2023 13:27:23	- -21.71132	- 64.606681	580	67.1	1728.27	-4.67	1.75	2.6	San Mateo - Sella vuelta
3/21/2023 13:27:24	- 21.710847	- 64.606544	600	66.82	1727.5	-3.83	1.52	1.89	San Mateo - Sella vuelta
3/21/2023 13:27:25	- 21.710698	- 64.606502	620	66.8	1727.1	-2	1.66	1.9	San Mateo - Sella vuelta
3/21/2023 13:27:26	- 21.710552	- 64.606461	640	65.93	1726.9	-1	1.7	1.91	San Mateo - Sella vuelta

Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
3/21/2023 13:27:27	- 21.710414	- 64.606422	660	65.46	1726.9	0	1.65	1.74	San Mateo - Sella vuelta
3/21/2023 13:27:28	- 21.710043	- 64.606309	720	60.19	1727.93	2.17	1.49	1.71	San Mateo - Sella vuelta
3/21/2023 13:27:29	- 21.709669	- 64.606149	740	57.78	1728.3	1.83	1.56	3.91	San Mateo - Sella vuelta
3/21/2023 13:27:30	- 21.709575	- 64.606096	760	57.27	1728.45	0.75	1.47	2.11	San Mateo - Sella vuelta
3/21/2023 13:27:31	- 21.709485	- 64.606041	780	57.49	1728.45	0	1.54	2.31	San Mateo - Sella vuelta
3/21/2023 13:27:32	- 21.709396	- 64.605982	800	57.06	1727.87	-2.92	1.65	2.05	San Mateo - Sella vuelta
3/21/2023 13:27:33	- 21.709084	- 64.605732	820	57.13	1726.7	-5.83	1.54	1.85	San Mateo - Sella vuelta
3/21/2023 13:27:34	- 21.709003	- 64.605655	840	57.68	1725.55	-5.75	1.55	1.77	San Mateo - Sella vuelta
3/21/2023 13:27:35	- 21.708922	- 64.605574	860	58.08	1724.25	-6.5	1.61	2.52	San Mateo - Sella vuelta
3/21/2023 13:27:36	- 21.708844	- 64.605491	880	57.37	1722.27	-9.92	1.5	2.43	San Mateo - Sella vuelta
3/21/2023 13:27:37	- 21.708584	- 64.605175	900	57.32	1720.65	-8.08	1.4	2.03	San Mateo - Sella vuelta
3/21/2023 13:27:38	- 21.708456	- 64.604985	940	57.91	1719.15	-3.5	4.41	2.93	San Mateo - Sella vuelta
3/21/2023 13:27:39	- 21.708393	- 64.604886	960	55.43	1718.17	-4.92	14.53	3.25	San Mateo - Sella vuelta

**Nombre del tramo:** Ruta Nacional 1 (Cruce Calamuchita – Entrada a Muturayo)

**Carril de ida**

Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
3/29/2023 9:42:51 AM	- 21.454135	- 64.738748	20	27.4	2021.23	0	2.61	0.92	Calamuchita - Muturayo ida
3/29/2023 9:42:53 AM	- 21.454312	- 64.738818	40	32.23	2019.6	-8.17	5.36	3.06	Calamuchita - Muturayo ida
3/29/2023 9:42:55 AM	- 21.454477	- 64.738887	60	34.82	2017.77	-9.17	7.18	3.51	Calamuchita - Muturayo ida
3/29/2023 9:42:57 AM	- 21.454649	- 64.738958	80	37.28	2016.63	-5.67	4.82	3.02	Calamuchita - Muturayo ida
3/29/2023 9:42:59 AM	- 21.454831	- 64.739021	100	38.46	2016.77	0.67	3.73	3.4	Calamuchita - Muturayo ida
3/29/2023 9:43:01 AM	- 21.455025	- 64.739088	120	38.82	2016.9	0.67	4.01	3.46	Calamuchita - Muturayo ida
3/29/2023 9:43:03 AM	- 21.455221	- 64.739163	140	36.96	2016.47	-2.17	4.66	2.97	Calamuchita - Muturayo ida
3/29/2023 9:43:05 AM	- 21.455403	- 64.739241	160	34.78	2015.33	-5.67	4.15	3.45	Calamuchita - Muturayo ida
3/29/2023 9:43:07 AM	- 21.455559	- 64.739304	180	29.54	2014.53	-4	3.44	3.18	Calamuchita - Muturayo ida
3/29/2023 9:43:09 AM	- 21.455658	-64.73934	200	27.68	2014.07	-2.33	8.69	3.12	Calamuchita - Muturayo ida
3/29/2023 9:43:11 AM	- 21.455758	- 64.739377	220	34.25	2014.25	0.92	4.73	3.56	Calamuchita - Muturayo ida
3/29/2023 9:43:14 AM	- 21.456097	- 64.739487	240	40	2014.8	2.75	3.79	3.71	Calamuchita - Muturayo ida



Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
3/29/2023 9:43:15 AM	- 21.456123	- 64.739496	260	44.73	2015.03	1.17	3.38	2.87	Calamuchita - Muturayo ida
3/29/2023 9:43:17 AM	- 21.456399	- 64.739588	280	49.88	2015.1	0.33	4.65	3.69	Calamuchita - Muturayo ida
3/29/2023 9:43:18 AM	- 21.456472	- 64.739613	300	53.21	2015.47	1.83	6.92	5.62	Calamuchita - Muturayo ida
3/29/2023 9:43:20 AM	- 21.456813	- 64.739756	320	55.98	2016.05	2.92	6.79	5.52	Calamuchita - Muturayo ida
3/29/2023 9:43:21 AM	- 21.456905	- 64.739802	340	56.81	2016.35	1.5	7.92	5.8	Calamuchita - Muturayo ida
3/29/2023 9:43:22 AM	- 21.457004	-64.73985	360	58.32	2016.55	1	6.73	5.39	Calamuchita - Muturayo ida
3/29/2023 9:43:23 AM	- 21.457108	- 64.739901	380	59.43	2016.55	0	3.02	4.26	Calamuchita - Muturayo ida
3/29/2023 9:43:24 AM	- 21.457216	- 64.739954	400	60.26	2016.33	-1.08	2.47	3.47	Calamuchita - Muturayo ida
3/29/2023 9:43:26 AM	- 21.457605	- 64.740162	420	60.11	2016.15	-0.92	2.43	3.13	Calamuchita - Muturayo ida
3/29/2023 9:43:27 AM	- 21.457709	- 64.740227	440	59.66	2016.05	-0.5	4.9	3.74	Calamuchita - Muturayo ida
3/29/2023 9:43:28 AM	- 21.457808	-64.74029	460	59.35	2015.8	-1.25	6.86	4.28	Calamuchita - Muturayo ida
3/29/2023 9:43:29 AM	- 21.457905	- 64.740351	480	57.05	2015.33	-2.33	6.57	4.69	Calamuchita - Muturayo ida
3/29/2023 9:43:31 AM	- 21.458232	- 64.740557	500	53.32	2015.1	-1.17	4.57	3.5	Calamuchita - Muturayo ida

Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
3/29/2023 9:43:32 AM	- 21.458292	- 64.740595	520	47.22	2014.73	-1.83	3.85	2.84	Calamuchita - Maturayo ida
3/29/2023 9:43:34 AM	- 21.458526	- 64.74075	540	45.51	2014.15	-2.92	7.84	5.26	Calamuchita - Maturayo ida
3/29/2023 9:43:35 AM	- 21.458572	- 64.74078	560	48.6	2013.63	-2.58	6.25	4.61	Calamuchita - Maturayo ida
3/29/2023 9:43:37 AM	- 21.458841	- 64.74095	580	51.02	2013.1	-2.67	5.4	5.28	Calamuchita - Maturayo ida
3/29/2023 9:43:38 AM	- 21.458908	- 64.740992	600	52.98	2012.8	-1.5	4.08	4.6	Calamuchita - Maturayo ida
3/29/2023 9:43:39 AM	- 21.458984	- 64.74104	620	54.81	2012.63	-0.83	3.67	4.04	Calamuchita - Maturayo ida
3/29/2023 9:43:41 AM	- 21.459302	- 64.741246	640	55.15	2012.5	-0.67	6.56	4.84	Calamuchita - Maturayo ida
3/29/2023 9:43:42 AM	- 21.459386	- 64.741299	660	54.96	2012.35	-0.75	6.59	5.89	Calamuchita - Maturayo ida
3/29/2023 9:43:43 AM	- 21.45947	- 64.74135	680	54.45	2011.97	-1.92	2.67	3.37	Calamuchita - Maturayo ida
3/29/2023 9:43:45 AM	- 21.459787	- 64.741548	700	52.15	2011.7	-1.33	2.87	2.16	Calamuchita - Maturayo ida
3/29/2023 9:43:46 AM	- 21.459854	- 64.74159	720	50.39	2011.75	0.25	9.89	4.89	Calamuchita - Maturayo ida
3/29/2023 9:43:47 AM	- 21.45992	- 64.74163	740	50.85	2011.73	-0.08	9.25	6.7	Calamuchita - Maturayo ida
3/29/2023 9:43:49 AM	- 21.460221	- 64.741809	760	51.87	2011.6	-0.67	8.66	7.88	Calamuchita - Maturayo ida

Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
3/29/2023 9:43:50 AM	-21.4603	64.741857	780	53.74	2011.45	-0.75	7.37	7.37	Calamuchita - Muturayo ida
3/29/2023 9:43:51 AM	21.460385	64.741908	800	56.75	2011.37	-0.42	3.15	4.3	Calamuchita - Muturayo ida
3/29/2023 9:43:53 AM	21.460722	64.742113	820	59.17	2011.35	-0.08	4.91	3.68	Calamuchita - Muturayo ida
3/29/2023 9:43:54 AM	21.460821	64.742176	840	60.43	2011.25	-0.5	7.18	5.56	Calamuchita - Muturayo ida
3/29/2023 9:43:55 AM	21.460925	-64.74224	860	61.41	2011	-1.25	5.9	5.8	Calamuchita - Muturayo ida
3/29/2023 9:43:56 AM	21.461033	64.742307	880	62.21	2011.25	1.25	3.66	4.06	Calamuchita - Muturayo ida
3/29/2023 9:43:57 AM	21.461142	64.742373	900	62.31	2010.97	-1.42	6.8	5.27	Calamuchita - Muturayo ida
3/29/2023 9:43:59 AM	21.461509	64.742591	920	61.38	2009.7	-6.33	7.04	5.57	Calamuchita - Muturayo ida
3/29/2023 9:44:00 AM	21.461614	64.742655	940	59.93	2008.85	-4.25	6.25	4.6	Calamuchita - Muturayo ida
3/29/2023 9:44:01 AM	21.461716	64.742719	960	58.95	2008.2	-3.25	7.05	5.57	Calamuchita - Muturayo ida
3/29/2023 9:44:02 AM	21.461813	64.742781	980	56.73	2007	-6	6.24	5.56	Calamuchita - Muturayo ida
3/29/2023 9:44:04 AM	21.462141	64.742985	1000	53.85	2005.8	-6	4.42	4.04	Calamuchita - Muturayo ida
3/29/2023 9:44:05 AM	21.462213	64.743031	1020	50.87	2005.1	-3.5	5.63	4.36	Calamuchita - Muturayo ida

Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
3/29/2023 9:44:06 AM	-21.46227	64.743068	1040	45.27	2004.5	-3	6.09	4.03	Calamuchita - Maturayo ida
3/29/2023 9:44:08 AM	21.462488	64.743205	1060	31.88	2004.3	-1	4.92	2.75	Calamuchita - Maturayo ida
3/29/2023 9:44:10 AM	21.462715	64.743343	1080	23.1	2004.4	0.5	5	2.06	Calamuchita - Maturayo ida
3/29/2023 9:44:15 AM	21.462803	64.743394	1100	27.73	2005.95	7.75	4.76	1.94	Calamuchita - Maturayo ida
3/29/2023 9:44:18 AM	21.463029	64.743516	1120	33.79	2008.77	14.08	5.78	3.7	Calamuchita - Maturayo ida

### Depuración de datos

MEDIA

$$\bar{X} = \frac{\sum_{j=1}^n X_j}{n} = \frac{X_1 + X_2 + \dots + X_n}{n} = 4.213$$

VARIANZA

$$\sigma^2 = \frac{\sum_{j=1}^n (X_j - \mu)^2}{N} = \overline{(x - \mu)^2} = 1.802$$

DESVIACIÓN ESTANDAR

$$\sigma = \sqrt{\frac{\sum_{j=1}^n (X_j - \mu)^2}{N}} = \sqrt{\overline{(x - \mu)^2}} = 1.342$$

RANGO

$$(\bar{x} \pm \sigma) = (2.870 - 5.555)$$

Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
3/29/2023 9:42:53 AM	- 21.454312	- 64.738818	40	32.23	2019.6	-8.17	5.36	3.06	Calamuchita - Muturayo ida
3/29/2023 9:42:55 AM	- 21.454477	- 64.738887	60	34.82	2017.77	-9.17	7.18	3.51	Calamuchita - Muturayo ida
3/29/2023 9:42:57 AM	- 21.454649	- 64.738958	80	37.28	2016.63	-5.67	4.82	3.02	Calamuchita - Muturayo ida
3/29/2023 9:42:59 AM	- 21.454831	- 64.739021	100	38.46	2016.77	0.67	3.73	3.4	Calamuchita - Muturayo ida
3/29/2023 9:43:01 AM	- 21.455025	- 64.739088	120	38.82	2016.9	0.67	4.01	3.46	Calamuchita - Muturayo ida
3/29/2023 9:43:03 AM	- 21.455221	- 64.739163	140	36.96	2016.47	-2.17	4.66	2.97	Calamuchita - Muturayo ida
3/29/2023 9:43:05 AM	- 21.455403	- 64.739241	160	34.78	2015.33	-5.67	4.15	3.45	Calamuchita - Muturayo ida
3/29/2023 9:43:07 AM	- 21.455559	- 64.739304	180	29.54	2014.53	-4	3.44	3.18	Calamuchita - Muturayo ida
3/29/2023 9:43:09 AM	- 21.455658	- -64.73934	200	27.68	2014.07	-2.33	8.69	3.12	Calamuchita - Muturayo ida
3/29/2023 9:43:11 AM	- 21.455758	- 64.739377	220	34.25	2014.25	0.92	4.73	3.56	Calamuchita - Muturayo ida
3/29/2023 9:43:14 AM	- 21.456097	- 64.739487	240	40	2014.8	2.75	3.79	3.71	Calamuchita - Muturayo ida
3/29/2023 9:43:15 AM	- 21.456123	- 64.739496	260	44.73	2015.03	1.17	3.38	2.87	Calamuchita - Muturayo ida

Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
3/29/2023 9:43:17 AM	- 21.456399	- 64.739588	280	49.88	2015.1	0.33	4.65	3.69	Calamuchita - Maturayo ida
3/29/2023 9:43:20 AM	- 21.456813	- 64.739756	320	55.98	2016.05	2.92	6.79	5.52	Calamuchita - Maturayo ida
3/29/2023 9:43:22 AM	- 21.457004	- -64.73985	360	58.32	2016.55	1	6.73	5.39	Calamuchita - Maturayo ida
3/29/2023 9:43:23 AM	- 21.457108	- 64.739901	380	59.43	2016.55	0	3.02	4.26	Calamuchita - Maturayo ida
3/29/2023 9:43:24 AM	- 21.457216	- 64.739954	400	60.26	2016.33	-1.08	2.47	3.47	Calamuchita - Maturayo ida
3/29/2023 9:43:26 AM	- 21.457605	- 64.740162	420	60.11	2016.15	-0.92	2.43	3.13	Calamuchita - Maturayo ida
3/29/2023 9:43:27 AM	- 21.457709	- 64.740227	440	59.66	2016.05	-0.5	4.9	3.74	Calamuchita - Maturayo ida
3/29/2023 9:43:28 AM	- 21.457808	- -64.74029	460	59.35	2015.8	-1.25	6.86	4.28	Calamuchita - Maturayo ida
3/29/2023 9:43:29 AM	- 21.457905	- 64.740351	480	57.05	2015.33	-2.33	6.57	4.69	Calamuchita - Maturayo ida
3/29/2023 9:43:31 AM	- 21.458232	- 64.740557	500	53.32	2015.1	-1.17	4.57	3.5	Calamuchita - Maturayo ida
3/29/2023 9:43:34 AM	- 21.458526	- -64.74075	540	45.51	2014.15	-2.92	7.84	5.26	Calamuchita - Maturayo ida
3/29/2023 9:43:35 AM	- 21.458572	- -64.74078	560	48.6	2013.63	-2.58	6.25	4.61	Calamuchita - Maturayo ida
3/29/2023 9:43:37 AM	- 21.458841	- -64.74095	580	51.02	2013.1	-2.67	5.4	5.28	Calamuchita - Maturayo ida

Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
3/29/2023 9:43:38 AM	- 21.458908	- 64.740992	600	52.98	2012.8	-1.5	4.08	4.6	Calamuchita - Muturayo ida
3/29/2023 9:43:39 AM	- 21.458984	- 64.74104	620	54.81	2012.63	-0.83	3.67	4.04	Calamuchita - Muturayo ida
3/29/2023 9:43:41 AM	- 21.459302	- 64.741246	640	55.15	2012.5	-0.67	6.56	4.84	Calamuchita - Muturayo ida
3/29/2023 9:43:43 AM	- -21.45947	- -64.74135	680	54.45	2011.97	-1.92	2.67	3.37	Calamuchita - Muturayo ida
3/29/2023 9:43:46 AM	- 21.459854	- -64.74159	720	50.39	2011.75	0.25	9.89	4.89	Calamuchita - Muturayo ida
3/29/2023 9:43:51 AM	- 21.460385	- 64.741908	800	56.75	2011.37	-0.42	3.15	4.3	Calamuchita - Muturayo ida
3/29/2023 9:43:53 AM	- 21.460722	- 64.742113	820	59.17	2011.35	-0.08	4.91	3.68	Calamuchita - Muturayo ida
3/29/2023 9:43:56 AM	- 21.461033	- 64.742307	880	62.21	2011.25	1.25	3.66	4.06	Calamuchita - Muturayo ida
3/29/2023 9:43:57 AM	- 21.461142	- 64.742373	900	62.31	2010.97	-1.42	6.8	5.27	Calamuchita - Muturayo ida
3/29/2023 9:44:00 AM	- 21.461614	- 64.742655	940	59.93	2008.85	-4.25	6.25	4.6	Calamuchita - Muturayo ida
3/29/2023 9:44:04 AM	- 21.462141	- 64.742985	1000	53.85	2005.8	-6	4.42	4.04	Calamuchita - Muturayo ida
3/29/2023 9:44:05 AM	- 21.462213	- 64.743031	1020	50.87	2005.1	-3.5	5.63	4.36	Calamuchita - Muturayo ida
3/29/2023 9:44:06 AM	- -21.46227	- 64.743068	1040	45.27	2004.5	-3	6.09	4.03	Calamuchita - Muturayo ida
3/29/2023 9:44:18 AM	- 21.463029	- 64.743516	1120	33.79	2008.77	14.08	5.78	3.7	Calamuchita - Muturayo ida

**Nombre del tramo:** Ruta Nacional 1 (Cruce Calamuchita – Entrada a Muturayo)  
**Carril de vuelta**

Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
3/22/2023 5:12:40 PM	- 21.464033	- 64.744028	20	24.7	2001.9	0	6.57	0.78	Calamuchita - Muturayo vuelta
3/22/2023 5:12:42 PM	- 21.463899	- 64.743957	40	30.27	2002.33	2.17	2.98	2.62	Calamuchita - Muturayo vuelta
3/22/2023 5:12:44 PM	- -21.46377	- 64.743888	60	36.54	2003.83	7.5	4.96	3.1	Calamuchita - Muturayo vuelta
3/22/2023 5:12:46 PM	- 21.463594	- 64.743793	80	41.65	2005.43	8	6.27	3.51	Calamuchita - Muturayo vuelta
3/22/2023 5:12:48 PM	- 21.463369	- 64.743671	100	43.64	2006.77	6.67	5.17	3.94	Calamuchita - Muturayo vuelta
3/22/2023 5:12:50 PM	- 21.463127	- 64.743541	120	45.93	2007.45	3.42	2.1	3.08	Calamuchita - Muturayo vuelta
3/22/2023 5:12:51 PM	- 21.463077	- 64.743512	140	48.1	2007.8	1.75	2.94	2.73	Calamuchita - Muturayo vuelta
3/22/2023 5:12:52 PM	- 21.463016	- 64.743477	160	51.72	2008.5	3.5	3.24	3.21	Calamuchita - Muturayo vuelta
3/22/2023 5:12:54 PM	- 21.462713	- 64.743287	180	55.2	2009.1	3	2.62	3.16	Calamuchita - Muturayo vuelta
3/22/2023 5:12:55 PM	- 21.462624	- 64.743232	200	57.73	2009.3	1	4	4.29	Calamuchita - Muturayo vuelta
3/22/2023 5:12:56 PM	- 21.462526	- 64.743172	220	60.33	2009.65	1.75	4.18	4.56	Calamuchita - Muturayo vuelta
3/22/2023 5:12:57 PM	- 21.462415	- 64.743105	240	62.81	2010.03	1.92	4.41	3.67	Calamuchita - Muturayo vuelta



Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
3/22/2023 5:12:59 PM	- 21.462016	- 64.742863	260	64.1	2010.25	1.08	2.6	3.48	Calamuchita - Maturayo vuelta
3/22/2023 5:13:00 PM	- 21.461894	- -64.74279	280	65.07	2010.6	1.75	2.5	3.72	Calamuchita - Maturayo vuelta
3/22/2023 5:13:01 PM	- 21.461769	- 64.742713	300	64.73	2010.95	1.75	2.47	4	Calamuchita - Maturayo vuelta
3/22/2023 5:13:02 PM	- 21.461647	- 64.742638	320	63.24	2011.25	1.5	4.8	5.02	Calamuchita - Maturayo vuelta
3/22/2023 5:13:03 PM	- 21.461531	- 64.742568	340	61.63	2011.55	1.5	6.3	4.46	Calamuchita - Maturayo vuelta
3/22/2023 5:13:04 PM	- 21.461422	- 64.742503	360	60.47	2011.93	1.92	3.68	3.42	Calamuchita - Maturayo vuelta
3/22/2023 5:13:06 PM	- -21.46106	- 64.742285	380	59.69	2012.2	1.33	3.06	3.62	Calamuchita - Maturayo vuelta
3/22/2023 5:13:07 PM	- 21.460958	- 64.742222	400	59.88	2012.3	0.5	4.21	3.86	Calamuchita - Maturayo vuelta
3/22/2023 5:13:08 PM	- 21.460856	- 64.742159	420	60.43	2012.25	-0.25	4.07	4.73	Calamuchita - Maturayo vuelta
3/22/2023 5:13:09 PM	- -21.46075	- 64.742093	440	61.58	2012.25	0	4.61	4.57	Calamuchita - Maturayo vuelta
3/22/2023 5:13:10 PM	- 21.460636	- 64.742022	460	62.92	2012.4	0.75	5.72	4.36	Calamuchita - Maturayo vuelta
3/22/2023 5:13:11 PM	- 21.460517	- 64.741951	480	62.8	2012.67	1.33	4.14	4.32	Calamuchita - Maturayo vuelta
3/22/2023 5:13:13 PM	- 21.460128	- 64.741711	500	62.17	2012.85	0.92	6.11	5.16	Calamuchita - Maturayo vuelta

Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
3/22/2023 5:13:14 PM	- 21.460014	- -64.74164	520	61.64	2013	0.75	5.69	4.09	Calamuchita - Muturayo vuelta
3/22/2023 5:13:15 PM	- 21.459901	- 64.741568	540	61.19	2013.35	1.75	17.35	9.69	Calamuchita - Muturayo vuelta
3/22/2023 5:13:16 PM	- 21.459791	- 64.741498	560	61.43	2013.7	1.75	18.14	9.94	Calamuchita - Muturayo vuelta
3/22/2023 5:13:17 PM	- 21.459678	- 64.741429	580	62.51	2013.75	0.25	4.38	3.59	Calamuchita - Muturayo vuelta
3/22/2023 5:13:18 PM	- 21.459559	- 64.741357	600	63.94	2013.85	0.5	4.89	4.4	Calamuchita - Muturayo vuelta
3/22/2023 5:13:19 PM	- 21.459433	- 64.741283	620	65.39	2014.2	1.75	4.71	4.23	Calamuchita - Muturayo vuelta
3/22/2023 5:13:21 PM	- 21.459018	- 64.741023	640	65.03	2014.6	2	7.28	4.81	Calamuchita - Muturayo vuelta
3/22/2023 5:13:22 PM	- 21.458897	- 64.740945	660	63.34	2015.05	2.25	4.77	4.87	Calamuchita - Muturayo vuelta
3/22/2023 5:13:23 PM	- 21.458788	- 64.740876	680	62.72	2015.7	3.25	3.86	4.44	Calamuchita - Muturayo vuelta
3/22/2023 5:13:24 PM	- 21.458707	- 64.740824	700	49.48	2016.53	4.17	6.15	4.85	Calamuchita - Muturayo vuelta
3/22/2023 5:13:26 PM	- 21.458498	- 64.740692	720	33.12	2017.05	2.58	3.04	2.29	Calamuchita - Muturayo vuelta
3/22/2023 5:13:27 PM	- 21.458391	- 64.740619	740	25.22	2017.13	0.42	5.93	2.11	Calamuchita - Muturayo vuelta
3/22/2023 5:13:34 PM	- 21.458192	- 64.740491	760	29.69	2017	-0.67	2.26	2.82	Calamuchita - Muturayo vuelta

Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
3/22/2023 5:13:36 PM	- 21.458067	- -64.74041	780	39.3	2016.97	-0.17	4.48	3.05	Calamuchita - Muturayo vuelta
3/22/2023 5:13:38 PM	- 21.457863	- 64.740275	800	43.62	2017.2	1.17	10.71	4.31	Calamuchita - Muturayo vuelta
3/22/2023 5:13:39 PM	- 21.457825	- 64.740251	820	46.06	2017.27	0.33	7.22	4.1	Calamuchita - Muturayo vuelta
3/22/2023 5:13:41 PM	- 21.457562	- 64.740096	840	50.5	2017.4	0.67	3.11	3.65	Calamuchita - Muturayo vuelta
3/22/2023 5:13:42 PM	- 21.457483	- 64.740056	860	53.53	2017.6	1	2.84	2.89	Calamuchita - Muturayo vuelta
3/22/2023 5:13:43 PM	- -21.45739	- -64.74001	880	57.5	2017.77	0.83	5.34	4.15	Calamuchita - Muturayo vuelta
3/22/2023 5:13:45 PM	- 21.457006	- -64.73983	900	61.42	2018.4	3.17	10.07	3.79	Calamuchita - Muturayo vuelta
3/22/2023 5:13:46 PM	- 21.456876	- 64.739778	920	63.42	2018.75	1.75	11.44	5.41	Calamuchita - Muturayo vuelta
3/22/2023 5:13:47 PM	- 21.456745	- 64.739726	940	64.09	2018.7	-0.25	7	5.18	Calamuchita - Muturayo vuelta
3/22/2023 5:13:48 PM	- -21.45661	- 64.739674	960	65.56	2018.9	1	2.2	3.46	Calamuchita - Muturayo vuelta
3/22/2023 5:13:49 PM	- 21.456464	- 64.739618	980	67.16	2019.5	3	3.06	4.05	Calamuchita - Muturayo vuelta
3/22/2023 5:13:50 PM	- -21.45632	- 64.739562	1000	65.08	2020.05	2.75	4.4	4.53	Calamuchita - Muturayo vuelta
3/22/2023 5:13:51 PM	- 21.456197	- 64.739514	1020	55.06	2020.37	1.58	3.36	3.6	Calamuchita - Muturayo vuelta

Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
3/22/2023 5:13:53 PM	- 21.455886	- 64.739391	1040	39.69	2020.73	1.83	3.11	2.75	Calamuchita - Maturayo vuelta
3/22/2023 5:13:55 PM	- 21.455718	- 64.739328	1060	27.91	2021.15	2.08	3.71	3.05	Calamuchita - Maturayo vuelta
3/22/2023 5:13:56 PM	- 21.455687	- 64.739317	1080	27.3	2019.25	-9.5	2.88	4.52	Calamuchita - Maturayo vuelta
3/22/2023 5:14:01 PM	- 21.455374	- 64.739204	1100	38.77	2014.07	-25.92	4.37	2.73	Calamuchita - Maturayo vuelta
3/22/2023 5:14:03 PM	- 21.455161	- 64.739125	1120	42.9	2011.6	-12.33	9.32	5.62	Calamuchita - Maturayo vuelta
3/22/2023 5:14:04 PM	- 21.455123	- -64.73911	1140	45.41	2009.83	-8.83	5.62	4.97	Calamuchita - Maturayo vuelta
3/22/2023 5:14:06 PM	- 21.454855	- 64.739006	1160	49.26	2008.65	-5.92	3.54	4.38	Calamuchita - Maturayo vuelta
3/22/2023 5:14:07 PM	- 21.454791	- -64.73898	1180	45.26	2008.53	-0.58	2.91	3.44	Calamuchita - Maturayo vuelta
3/22/2023 5:14:09 PM	- 21.454542	- 64.738874	1200	32.92	2007.97	-2.83	2.85	2.84	Calamuchita - Maturayo vuelta

Depuración de datos

MEDIA

$$\bar{X} = \frac{\sum_{j=1}^n X_j}{n} = \frac{X_1 + X_2 + \dots + X_n}{n} = 4.033$$

VARIANZA

$$\sigma^2 = \frac{\sum_{j=1}^n (x_j - \mu)^2}{N} = \overline{(x - \mu)^2} = 1.977$$

DESVIACIÓN ESTANDAR

$$\sigma = \sqrt{\frac{\sum_{j=1}^n (x_j - \mu)^2}{N}} = \sqrt{\overline{(x - \mu)^2}} = 1.406$$

RANGO

$$(\bar{x} \pm \sigma) = (2.627 - 5.439)$$

Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
3/22/2023 5:12:44 PM	-21.46377	64.743888	20	36.54	2003.83	7.5	4.96	3.1	Calamuchita - Maturayo vuelta
3/22/2023 5:12:46 PM	21.463594	64.743793	40	41.65	2005.43	8	6.27	3.51	Calamuchita - Maturayo vuelta
3/22/2023 5:12:48 PM	21.463369	64.743671	60	43.64	2006.77	6.67	5.17	3.94	Calamuchita - Maturayo vuelta
3/22/2023 5:12:50 PM	21.463127	64.743541	80	45.93	2007.45	3.42	2.1	3.08	Calamuchita - Maturayo vuelta
3/22/2023 5:12:51 PM	21.463077	64.743512	100	48.1	2007.8	1.75	2.94	2.73	Calamuchita - Maturayo vuelta
3/22/2023 5:12:52 PM	21.463016	64.743477	120	51.72	2008.5	3.5	3.24	3.21	Calamuchita - Maturayo vuelta
3/22/2023 5:12:54 PM	21.462713	64.743287	140	55.2	2009.1	3	2.62	3.16	Calamuchita - Maturayo vuelta
3/22/2023 5:12:55 PM	21.462624	64.743232	160	57.73	2009.3	1	4	4.29	Calamuchita - Maturayo vuelta

Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
3/22/2023 5:12:56 PM	- 21.462526	- 64.743172	180	60.33	2009.65	1.75	4.18	4.56	Calamuchita - Muturayo vuelta
3/22/2023 5:12:57 PM	- 21.462415	- 64.743105	200	62.81	2010.03	1.92	4.41	3.67	Calamuchita - Muturayo vuelta
3/22/2023 5:12:59 PM	- 21.462016	- 64.742863	220	64.1	2010.25	1.08	2.6	3.48	Calamuchita - Muturayo vuelta
3/22/2023 5:13:00 PM	- 21.461894	- -64.74279	240	65.07	2010.6	1.75	2.5	3.72	Calamuchita - Muturayo vuelta
3/22/2023 5:13:01 PM	- 21.461769	- 64.742713	260	64.73	2010.95	1.75	2.47	4	Calamuchita - Muturayo vuelta
3/22/2023 5:13:02 PM	- 21.461647	- 64.742638	280	63.24	2011.25	1.5	4.8	5.02	Calamuchita - Muturayo vuelta
3/22/2023 5:13:03 PM	- 21.461531	- 64.742568	300	61.63	2011.55	1.5	6.3	4.46	Calamuchita - Muturayo vuelta
3/22/2023 5:13:04 PM	- 21.461422	- 64.742503	320	60.47	2011.93	1.92	3.68	3.42	Calamuchita - Muturayo vuelta
3/22/2023 5:13:06 PM	- -21.46106	- 64.742285	340	59.69	2012.2	1.33	3.06	3.62	Calamuchita - Muturayo vuelta
3/22/2023 5:13:07 PM	- 21.460958	- 64.742222	360	59.88	2012.3	0.5	4.21	3.86	Calamuchita - Muturayo vuelta
3/22/2023 5:13:08 PM	- 21.460856	- 64.742159	380	60.43	2012.25	-0.25	4.07	4.73	Calamuchita - Muturayo vuelta
3/22/2023 5:13:09 PM	- -21.46075	- 64.742093	400	61.58	2012.25	0	4.61	4.57	Calamuchita - Muturayo vuelta
3/22/2023 5:13:10 PM	- 21.460636	- 64.742022	420	62.92	2012.4	0.75	5.72	4.36	Calamuchita - Muturayo vuelta

Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
3/22/2023 5:13:11 PM	- 21.460517	- 64.741951	440	62.8	2012.67	1.33	4.14	4.32	Calamuchita - Muturayo vuelta
3/22/2023 5:13:13 PM	- 21.460128	- 64.741711	460	62.17	2012.85	0.92	6.11	5.16	Calamuchita - Muturayo vuelta
3/22/2023 5:13:14 PM	- 21.460014	- -64.74164	480	61.64	2013	0.75	5.69	4.09	Calamuchita - Muturayo vuelta
3/22/2023 5:13:17 PM	- 21.459678	- 64.741429	500	62.51	2013.75	0.25	4.38	3.59	Calamuchita - Muturayo vuelta
3/22/2023 5:13:18 PM	- 21.459559	- 64.741357	520	63.94	2013.85	0.5	4.89	4.4	Calamuchita - Muturayo vuelta
3/22/2023 5:13:19 PM	- 21.459433	- 64.741283	540	65.39	2014.2	1.75	4.71	4.23	Calamuchita - Muturayo vuelta
3/22/2023 5:13:21 PM	- 21.459018	- 64.741023	560	65.03	2014.6	2	7.28	4.81	Calamuchita - Muturayo vuelta
3/22/2023 5:13:22 PM	- 21.458897	- 64.740945	580	63.34	2015.05	2.25	4.77	4.87	Calamuchita - Muturayo vuelta
3/22/2023 5:13:23 PM	- 21.458788	- 64.740876	600	62.72	2015.7	3.25	3.86	4.44	Calamuchita - Muturayo vuelta
3/22/2023 5:13:24 PM	- 21.458707	- 64.740824	620	49.48	2016.53	4.17	6.15	4.85	Calamuchita - Muturayo vuelta
3/22/2023 5:13:34 PM	- 21.458192	- 64.740491	640	29.69	2017	-0.67	2.26	2.82	Calamuchita - Muturayo vuelta
3/22/2023 5:13:36 PM	- 21.458067	- -64.74041	660	39.3	2016.97	-0.17	4.48	3.05	Calamuchita - Muturayo vuelta
3/22/2023 5:13:38 PM	- 21.457863	- 64.740275	680	43.62	2017.2	1.17	10.71	4.31	Calamuchita - Muturayo vuelta

Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
3/22/2023 5:13:39 PM	- 21.457825	- 64.740251	700	46.06	2017.27	0.33	7.22	4.1	Calamuchita - Muturayo vuelta
3/22/2023 5:13:41 PM	- 21.457562	- 64.740096	720	50.5	2017.4	0.67	3.11	3.65	Calamuchita - Muturayo vuelta
3/22/2023 5:13:42 PM	- 21.457483	- 64.740056	740	53.53	2017.6	1	2.84	2.89	Calamuchita - Muturayo vuelta
3/22/2023 5:13:43 PM	- -21.45739	- -64.74001	760	57.5	2017.77	0.83	5.34	4.15	Calamuchita - Muturayo vuelta
3/22/2023 5:13:45 PM	- 21.457006	- -64.73983	780	61.42	2018.4	3.17	10.07	3.79	Calamuchita - Muturayo vuelta
3/22/2023 5:13:46 PM	- 21.456876	- 64.739778	800	63.42	2018.75	1.75	11.44	5.41	Calamuchita - Muturayo vuelta
3/22/2023 5:13:47 PM	- 21.456745	- 64.739726	820	64.09	2018.7	-0.25	7	5.18	Calamuchita - Muturayo vuelta
3/22/2023 5:13:48 PM	- -21.45661	- 64.739674	840	65.56	2018.9	1	2.2	3.46	Calamuchita - Muturayo vuelta
3/22/2023 5:13:49 PM	- 21.456464	- 64.739618	860	67.16	2019.5	3	3.06	4.05	Calamuchita - Muturayo vuelta
3/22/2023 5:13:50 PM	- -21.45632	- 64.739562	880	65.08	2020.05	2.75	4.4	4.53	Calamuchita - Muturayo vuelta
3/22/2023 5:13:51 PM	- 21.456197	- 64.739514	900	55.06	2020.37	1.58	3.36	3.6	Calamuchita - Muturayo vuelta
3/22/2023 5:13:53 PM	- 21.455886	- 64.739391	920	39.69	2020.73	1.83	3.11	2.75	Calamuchita - Muturayo vuelta
3/22/2023 5:13:55 PM	- 21.455718	- 64.739328	940	27.91	2021.15	2.08	3.71	3.05	Calamuchita - Muturayo vuelta



Date Time	Latitude	Longitude	Distance(m)	Speed (km/h)	Altitude (m)	Grade (%)	eIRI	cIRI	Roadroid
3/22/2023 5:13:56 PM	- 21.455687	- 64.739317	960	27.3	2019.25	-9.5	2.88	4.52	Calamuchita - Maturayo vuelta
3/22/2023 5:14:01 PM	- 21.455374	- 64.739204	980	38.77	2014.07	-25.92	4.37	2.73	Calamuchita - Maturayo vuelta
3/22/2023 5:14:04 PM	- 21.455123	- -64.73911	1000	45.41	2009.83	-8.83	5.62	4.97	Calamuchita - Maturayo vuelta
3/22/2023 5:14:06 PM	- 21.454855	- 64.739006	1020	49.26	2008.65	-5.92	3.54	4.38	Calamuchita - Maturayo vuelta
3/22/2023 5:14:07 PM	- 21.454791	- -64.73898	1040	45.26	2008.53	-0.58	2.91	3.44	Calamuchita - Maturayo vuelta
3/22/2023 5:14:09 PM	- 21.454542	- 64.738874	1060	32.92	2007.97	-2.83	2.85	2.84	Calamuchita - Maturayo vuelta

### RESULTADOS OBTENIDOS

Tramo rural	Media aplicación ROADROID	
	Ida	Vuelta
El Portillo-La Pintada (Cruce Ruta 11 Villamontes - Entrada al proyecto múltiples san Jacinto - oficinas) múltiples san Jacinto - oficinas)	3.69	3.98
Carretera San Mateo – Sella (Monte Méndez - Barrio El Taco)	2.79	2.67
Ruta Nacional 1 (Cruce Calamuchita – Entrada a Maturayo)	4.00	3.94



**ANEXO G.**  
**DATOS Y CÁLCULO DEL NIVEL DE**  
**SERVICIO ZONA URBANA**

## DATOS Y CÁLCULO DEL NIVEL DE SERVICIO

**Nombre del tramo:** Av. Jesús Molina (Cruce ruta San Jacinto - Casa del Mariachi)

### DATOS

ancho total = 11.5 m

ancho de carril = 5.75 m

ancho de berma = 0 m

cota = 1907 - 1860

longitud = 1000 m

pendiente = 4.7 %

aforo vehicular tramo 1 ( Av. Jesús Molina (Cruce ruta San Jacinto - Casa del Mariachi) ) de ida														
	6:00 - 7:00	7:00 - 8:00	8:00 - 9:00	9:00 - 10:00	10:00 - 11:00	11:00 - 12:00	12:00 - 13:00	13:00 - 14:00	14:00 - 15:00	15:00 - 16:00	16:00 - 17:00	17:00 - 18:00	18:00 - 19:00	19:00 - 20:00
lunes	15	22	27	18	16	19	32	30	11	20	17	9	15	11
martes	18	24	23	14	14	15	28	28	9	17	15	7	12	14
miércoles	14	28	20	12	12	11	25	32	9	14	12	5	14	10
jueves	22	42	19	12	16	14	31	29	7	15	14	9	15	12
viernes	25	37	22	16	13	16	29	27	13	18	10	11	19	9
sábado	15	23	14	20	21	11	10	14	20	10	16	20	19	17
domingo	12	20	10	14	18	13	9	12	16	7	12	17	16	14

aforo vehicular tramo 1 ( Av. Jesús Molina (Cruce ruta San Jacinto - Casa del Mariachi) ) de vuelta														
	6:00 - 7:00	7:00 - 8:00	8:00 - 9:00	9:00 - 10:00	10:00 - 11:00	11:00 - 12:00	12:00 - 13:00	13:00 - 14:00	14:00 - 15:00	15:00 - 16:00	16:00 - 17:00	17:00 - 18:00	18:00 - 19:00	19:00 - 20:00
lunes	18	33	15	11	15	17	22	37	9	22	11	10	13	8
martes	25	31	17	15	18	19	25	40	11	18	13	9	15	10
miércoles	22	28	20	18	19	15	27	34	13	15	18	15	19	11
jueves	20	26	23	14	19	11	28	25	10	13	16	12	17	15
viernes	24	20	22	20	22	16	30	28	16	19	20	18	21	18
sábado	11	16	18	28	23	14	13	20	13	16	18	17	23	21
domingo	9	12	20	23	18	11	16	22	15	13	16	13	18	15

Av. Jesús Molina (Cruce ruta San Jacinto - Casa del Mariachi)							
Aforo vehicular durante una semana							
Días	Lunes	Martes	Miércoles	Jueves	Viernes	Sábado	Domingo
Total de ida	262	238	218	257	265	230	190
Total de vuelta	241	266	274	249	294	251	221
Adoptado	294						

Volumen = 294 Veh

**Capacidad real**

$$C = 3200 * f_{pe} * f_d * f_{cd} * f_p$$

C = Capacidad real

$f_{pe}$  = Factor de correlación a la capacidad por pendiente

$f_d$  = Factor por distribución por sentidos y zonas de no rebase

$f_{cd}$  = Factor por ancho de carril y berma

$f_p$  = factor por presencia de vehículos pesados

Factor de corrección a la capacidad por pendiente  $f_{pe}$

PEND. ASC. %	LONGITUD DE LA PENDIENTE (km)											
	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0
0	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1	0.99	0.99	0.99	0.99	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
2	0.99	0.98	0.98	0.98	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
3	0.98	0.97	0.96	0.96	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
4	0.98	0.96	0.95	0.94	0.94	0.94	0.93	0.93	0.93	0.93	0.93	0.93
5	0.98	0.95	0.94	0.92	0.92	0.92	0.92	0.92	0.91	0.91	0.91	0.91
6	0.97	0.95	0.92	0.91	0.91	0.90	0.90	0.90	0.89	0.89	0.89	0.89
7	0.96	0.93	0.91	0.89	0.89	0.87	0.87	0.87	0.86	0.86	0.86	0.86
8	0.96	0.92	0.89	0.87	0.86	0.85	0.84	0.84	0.84	0.84	0.83	0.84
9	0.94	0.89	0.85	0.83	0.82	0.81	0.80	0.80	0.80	0.80	0.80	0.80
10	0.92	0.85	0.81	0.79	0.78	0.77	0.76	0.75	0.75	0.74	0.74	0.74
11	0.90	0.81	0.76	0.73	0.72	0.71	0.70	0.69	0.69	0.68	0.68	0.68
12	0.87	0.76	0.71	0.68	0.67	0.64	0.64	0.63	0.63	0.61	0.61	0.61

Factor de corrección a la capacidad por distribución por sentido  $f_d$

DISTRIBUCIÓN POR SENTIDOS A/D	PORCENTAJE DE ZONAS DE NO REBASE					
	0	20	40	60	80	100
50/50	1.00	1.00	1.00	1.00	1.00	1.00
60/40	0.90	0.89	0.87	0.86	0.85	0.83
70/30	0.82	0.80	0.78	0.76	0.74	0.71
80/20	0.75	0.72	0.70	0.67	0.65	0.63
90/10	0.69	0.66	0.64	0.61	0.58	0.56
100/100	0.64	0.61	0.58	0.56	0.53	0.50

Factor de corrección a la capacidad por efecto combinado del ancho de carril y berma

$$f_{cb}$$

ANCHO UTILIZABLE DE LA BERMA EN METROS	ANCHO DE CARRIL (m)				
	3.65	3.50	3.30	3.00	2.70
1.80	1.00	0.99	0.98	0.96	0.92
1.50	0.99	0.99	0.98	0.95	0.91
1.20	0.99	0.98	0.97	0.95	0.91
1.00	0.99	0.98	0.97	0.94	0.90
0.50	0.98	0.97	0.96	0.93	0.89
0.00	0.97	0.96	0.95	0.92	0.88

Factor de corrección a la capacidad por la presencia de vehículos pesados en pendientes

$$\text{ascendentes } f_p$$

PENDIENTE ASCENDENTE EN POR CIENTO	LONGITUD DE LA PENDIENTE (km)	PORCENTAJE DE VEHICULOS PESADOS					
		10	20	30	40	50	60
0	TODAS	0.95	0.90	0.87	0.84	0.81	0.78
1	0.5	0.95	0.90	0.87	0.84	0.81	0.78
	1.0	0.94	0.89	0.86	0.83	0.80	0.77
	1.5	0.93	0.88	0.85	0.82	0.80	0.77
	2.0	0.92	0.87	0.85	0.82	0.79	0.76
	3.0	0.91	0.87	0.84	0.82	0.79	0.76
	4.0	0.91	0.87	0.84	0.81	0.78	0.75
	≥5.0	0.90	0.87	0.83	0.81	0.78	0.75
2	0.5	0.94	0.90	0.85	0.83	0.80	0.77
	1.0	0.93	0.88	0.85	0.82	0.79	0.76
	1.5	0.92	0.88	0.84	0.81	0.79	0.76
	2.0	0.90	0.86	0.83	0.80	0.78	0.75
	3.0	0.88	0.85	0.82	0.79	0.76	0.73
	4.0	0.87	0.84	0.81	0.78	0.75	0.72
	≥5.0	0.86	0.83	0.80	0.77	0.74	0.72
3	0.5	0.94	0.89	0.84	0.81	0.78	0.75
	1.0	0.92	0.87	0.83	0.80	0.77	0.75
	1.5	0.89	0.85	0.81	0.78	0.75	0.73
	2.0	0.87	0.83	0.80	0.77	0.74	0.71
	3.0	0.86	0.82	0.79	0.76	0.73	0.70
	4.0	0.85	0.81	0.78	0.75	0.72	0.70
	≥5.0	0.84	0.80	0.78	0.75	0.72	0.69

PENDIENTE ASCENDENTE EN POR CIENTO	LONGITUD DE LA PENDIENTE (km)	PORCENTAJE DE VEHICULOS PESADOS					
		10	20	30	40	50	60
4	0.5	0.93	0.88	0.83	0.80	0.76	0.74
	1.0	0.89	0.83	0.80	0.77	0.74	0.71
	1.5	0.84	0.81	0.77	0.74	0.72	0.69
	2.0	0.83	0.79	0.76	0.73	0.70	0.68
	3.0	0.82	0.78	0.75	0.71	0.68	0.66
	4.0	0.81	0.77	0.74	0.71	0.68	0.65
	≥5.0	0.80	0.77	0.73	0.70	0.67	0.64
5	0.5	0.92	0.86	0.82	0.78	0.75	0.73
	1.0	0.85	0.80	0.77	0.74	0.71	0.69
	1.5	0.82	0.78	0.75	0.71	0.69	0.65
	2.0	0.80	0.77	0.73	0.70	0.67	0.63
	3.0	0.79	0.75	0.72	0.69	0.66	0.63
	4.0	0.78	0.74	0.71	0.68	0.65	0.62
	≥5.0	0.77	0.74	0.70	0.67	0.64	0.62
6	0.5	0.90	0.84	0.79	0.76	0.73	0.70
	1.0	0.81	0.77	0.73	0.70	0.67	0.65
	1.5	0.79	0.75	0.71	0.68	0.65	0.63
	2.0	0.77	0.74	0.70	0.67	0.64	0.62
	3.0	0.76	0.72	0.69	0.66	0.63	0.61
	4.0	0.75	0.72	0.68	0.65	0.63	0.60
	≥5.0	0.75	0.71	0.67	0.64	0.62	0.59
7	0.5	0.89	0.82	0.78	0.74	0.71	0.68
	1.0	0.78	0.74	0.71	0.67	0.64	0.61
	1.5	0.76	0.72	0.68	0.65	0.62	0.59
	2.0	0.74	0.70	0.67	0.63	0.60	0.57
	3.0	0.72	0.68	0.67	0.61	0.58	0.56
	4.0	0.71	0.67	0.64	0.60	0.57	0.55
	≥5.0	0.71	0.67	0.63	0.60	0.57	0.54
8	0.5	0.87	0.81	0.76	0.73	0.70	0.67
	1.0	0.76	0.72	0.68	0.65	0.62	0.59
	1.5	0.73	0.69	0.65	0.62	0.59	0.56
	2.0	0.71	0.67	0.63	0.60	0.57	0.53
	3.0	0.69	0.65	0.61	0.58	0.55	0.53
	4.0	0.68	0.64	0.60	0.57	0.54	0.52
	≥5.0	0.67	0.63	0.60	0.56	0.53	0.51
9	0.5	0.86	0.79	0.74	0.71	0.68	0.65
	1.0	0.74	0.70	0.67	0.64	0.60	0.58
	1.5	0.71	0.67	0.64	0.60	0.57	0.55
	2.0	0.70	0.66	0.62	0.59	0.56	0.53
	3.0	0.68	0.64	0.60	0.57	0.54	0.51
	4.0	0.67	0.63	0.59	0.56	0.53	0.50
	≥5.0	0.66	0.62	0.58	0.55	0.52	0.50
10	0.5	0.83	0.76	0.72	0.68	0.65	0.59
	1.0	0.70	0.66	0.62	0.59	0.56	0.52
	1.5	0.68	0.64	0.61	0.58	0.55	0.50
	2.0	0.66	0.62	0.58	0.55	0.52	0.48
	3.0	0.65	0.61	0.57	0.54	0.51	0.47
	4.0	0.64	0.60	0.56	0.53	0.50	0.46
	≥5.0	0.63	0.59	0.55	0.52	0.49	0.45
11	0.5	0.79	0.72	0.68	0.65	0.62	0.59
	1.0	0.69	0.65	0.61	0.58	0.55	0.52
	1.5	0.66	0.62	0.58	0.55	0.52	0.50
	2.0	0.64	0.60	0.57	0.54	0.51	0.48
	3.0	0.63	0.59	0.55	0.52	0.49	0.47
	4.0	0.62	0.58	0.54	0.51	0.48	0.46
	≥5.0	0.61	0.57	0.53	0.50	0.47	0.45
12	0.5	0.77	0.69	0.65	0.62	0.59	0.56
	1.0	0.66	0.62	0.59	0.55	0.52	0.50
	1.5	0.64	0.60	0.56	0.53	0.50	0.48
	2.0	0.62	0.58	0.55	0.52	0.49	0.46
	3.0	0.61	0.57	0.53	0.50	0.48	0.45
	4.0	0.60	0.56	0.53	0.49	0.47	0.44
	≥5.0	0.59	0.55	0.52	0.49	0.46	0.43

$$C = 3200 * 0.95 * 1 * 0.97 * 0.78$$

$$C = 2300.064$$

$$C = 2300 \text{ Veh/hr}$$

Nivel de servicio	Descripción de flujo vehicular	Factor
A	Flujo libre	0
B	Flujo estable	$\leq 0.1$
C	Flujo estable	$\leq 0.3$
D	Prox. a flujo inestable	$\leq 0.7$
E	Flujo inestable	= 1
F	Flujo inestable	> 1

### Nivel de servicio

$$NS = \frac{\text{Volumen}}{\text{capacidad}} = \frac{294}{2300}$$

$$NS = 0.13$$

$$NS = C = \text{Flujo estable}$$



**Nombre del tramo:** Av. Felipe Palazón (Rotonda Los Leones - Calle 10)

**Datos**

ancho total = 7.5 m

ancho de carril = 3.75 m

ancho de berma = 1 m

cota = 1859 - 1845

longitud = 1000 m

pendiente = 1.4 %

aforo vehicular tramo 1 ( Av. Felipe Palazón (Rotonda Los Leones - Calle 10) ) de ida														
	6:00 - 7:00	7:00 - 8:00	8:00 - 9:00	9:00 - 10:00	10:00 - 11:00	11:00 - 12:00	12:00 - 13:00	13:00 - 14:00	14:00 - 15:00	15:00 - 16:00	16:00 - 17:00	17:00 - 18:00	18:00 - 19:00	19:00 - 20:00
lunes	96	509	242	161	170	238	457	290	222	186	170	169	224	245
martes	93	507	237	155	166	233	453	286	220	183	173	171	226	240
miércoles	89	502	240	160	171	238	462	298	219	179	175	179	220	242
jueves	90	512	243	162	175	241	470	293	225	182	178	182	222	248
viernes	98	516	251	168	179	239	477	300	228	178	177	190	218	251
sábado	85	220	321	354	344	298	286	212	190	220	224	239	196	207
domingo	82	214	318	349	337	288	280	205	187	214	218	229	191	197

aforo vehicular tramo 1 (Av. Felipe Palazón (Rotonda Los Leones - Calle 10)) de vuelta														
	6:00 - 7:00	7:00 - 8:00	8:00 - 9:00	9:00 - 10:00	10:00 - 11:00	11:00 - 12:00	12:00 - 13:00	13:00 - 14:00	14:00 - 15:00	15:00 - 16:00	16:00 - 17:00	17:00 - 18:00	18:00 - 19:00	19:00 - 20:00
lunes	94	558	280	198	194	169	580	263	254	200	189	170	199	228
martes	91	566	283	191	190	166	572	258	249	203	171	173	194	223
miércoles	93	562	290	197	200	187	577	259	252	205	168	181	193	225
jueves	94	572	298	202	206	213	580	262	253	201	170	186	191	218
viernes	99	569	296	207	212	220	585	270	259	208	186	197	198	213
sábado	98	330	478	353	420	255	290	198	223	225	215	245	185	196
domingo	87	327	470	345	408	249	286	195	221	220	211	258	179	188

Av. Felipe Palazón (Rotonda Los Leones - Calle 10)							
Aforo vehicular durante una semana							
Días	Lunes	Martes	Miércoles	Jueves	Viernes	Sábado	Domingo
Total de ida	3379	3343	3374	3423	3470	3396	3309
Total de vuelta	3576	3530	3589	3646	3719	3711	3644
Adoptado	3719						

**Volumen** = 3719 Veh

### Capacidad real

$$C = 3200 * f_{pe} * f_d * f_{cd} * f_p$$

C = Capacidad real

$f_{pe}$  = Factor de correlación a la capacidad por pendiente

$f_d$  = Factor por distribución por sentidos y zonas de no rebase

$f_{cd}$  = Factor por ancho de carril y berma

$f_p$  = factor por presencia de vehículos pesados

$$C = 3200 * 0.98 * 1 * 0.99 * 0.82$$

$$C = 2545.80$$

$$C = 2545 \text{ Veh/hr}$$

### Nivel de servicio

$$NS = \frac{\text{Volumen}}{\text{capacidad}} = \frac{3719}{2545}$$

$$NS = 1.46$$

$NS = F = \text{Flujo inestable}$

Nivel de servicio	Descripción de flujo vehicular	Factor
A	Flujo libre	0
B	Flujo estable	$\leq 0.1$
C	Flujo estable	$\leq 0.3$
D	Prox. a flujo inestable	$\leq 0.7$
E	Flujo inestable	= 1
F	Flujo inestable	> 1

**ANEXO H.**  
**DATOS Y CÁLCULO DEL NIVEL DE**  
**SERVICIO ZONA RURAL**

## DATOS Y CALCULO DEL NIVEL DE SERVICIO

**Nombre del tramo:** El Portillo - La Pintada (Cruce Ruta 11 Villamontes - Entrada al proyecto múltiples san jacinto - oficinas)

### Datos

ancho total = 7.5 m

ancho de carril = 3.75 m

ancho de berma = 1 m

cota = 1870 - 1850

longitud = 1000 m

pendiente = 2 %

aforo vehicular tramo 1 ( El Portillo - La Pintada (Cruce Ruta 11 Villamontes - Entrada al proyecto múltiples san jacinto - oficinas) ) de ida														
	6:00 - 7:00	7:00 - 8:00	8:00 - 9:00	9:00 - 10:00	10:00 - 11:00	11:00 - 12:00	12:00 - 13:00	13:00 - 14:00	14:00 - 15:00	15:00 - 16:00	16:00 - 17:00	17:00 - 18:00	18:00 - 19:00	19:00 - 20:00
lunes	211	314	210	218	251	260	287	278	270	265	272	291	275	228
martes	207	317	194	212	246	252	281	273	267	262	279	287	266	230
miércoles	205	311	189	204	232	260	295	279	270	257	277	280	272	218
jueves	210	309	200	206	238	264	300	288	272	259	275	282	270	222
viernes	215	318	198	209	243	276	304	286	280	263	278	293	282	205
sábado	172	262	296	383	309	348	374	368	389	312	425	300	329	335
domingo	168	259	299	378	305	339	380	361	376	307	417	289	326	330

aforo vehicular tramo 1 ( El Portillo - La Pintada (Cruce Ruta 11 Villamontes - Entrada al proyecto múltiples san jacinto - oficinas) ) de vuelta														
	6:00 - 7:00	7:00 - 8:00	8:00 - 9:00	9:00 - 10:00	10:00 - 11:00	11:00 - 12:00	12:00 - 13:00	13:00 - 14:00	14:00 - 15:00	15:00 - 16:00	16:00 - 17:00	17:00 - 18:00	18:00 - 19:00	19:00 - 20:00
lunes	205	301	198	222	241	260	268	254	268	252	270	288	237	200
martes	202	298	186	207	239	254	269	242	260	249	266	283	235	208
miércoles	196	304	191	200	243	266	281	255	262	253	275	280	246	198
jueves	199	315	203	198	240	275	297	290	268	262	283	278	262	196
viernes	203	321	222	201	246	281	300	300	279	288	297	285	278	205
sábado	136	223	263	381	275	288	373	334	365	329	433	339	292	328
domingo	132	225	258	378	268	289	369	329	359	332	420	319	287	314

El Portillo - La Pintada (Cruce Ruta 11 Villamontes - Entrada al proyecto múltiples san jacinto - oficinas)							
Aforo vehicular durante una semana							
Días	Lunes	Martes	Miércoles	Jueves	Viernes	Sábado	Domingo
Total de ida	3630	3573	3549	3595	3650	4602	4534
Total de vuelta	3464	3398	3450	3566	3706	4359	4279
Adoptado	4602						

Volumen = 4602 Veh

### Capacidad real

$$C = 3200 * f_{pe} * f_d * f_{cd} * f_p$$

C = Capacidad real

$f_{pe}$  = Factor de correlación a la capacidad por pendiente

$f_d$  = Factor por distribución por sentidos y zonas de no rebase

$f_{cd}$  = Factor por ancho de carril y berma

$f_p$  = factor por presencia de vehículos pesados

Factor de corrección a la capacidad por pendiente  $f_{pe}$

PEND. ASC. %	LONGITUD DE LA PENDIENTE (km)											
	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0
0	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1	0.99	0.99	0.99	0.99	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
2	0.99	0.98	0.98	0.98	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
3	0.98	0.97	0.96	0.96	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
4	0.98	0.96	0.95	0.94	0.94	0.94	0.93	0.93	0.93	0.93	0.93	0.93
5	0.98	0.95	0.94	0.92	0.92	0.92	0.92	0.92	0.91	0.91	0.91	0.91
6	0.97	0.95	0.92	0.91	0.91	0.90	0.90	0.90	0.89	0.89	0.89	0.89
7	0.96	0.93	0.91	0.89	0.89	0.87	0.87	0.87	0.86	0.86	0.86	0.86
8	0.96	0.92	0.89	0.87	0.86	0.85	0.84	0.84	0.84	0.84	0.83	0.84
9	0.94	0.89	0.85	0.83	0.82	0.81	0.80	0.80	0.80	0.80	0.80	0.80
10	0.92	0.85	0.81	0.79	0.78	0.77	0.76	0.75	0.75	0.74	0.74	0.74
11	0.90	0.81	0.76	0.73	0.72	0.71	0.70	0.69	0.69	0.68	0.68	0.68
12	0.87	0.76	0.71	0.68	0.67	0.64	0.64	0.63	0.63	0.61	0.61	0.61

Factor de corrección a la capacidad por distribución por sentido  $f_d$

DISTRIBUCIÓN POR SENTIDOS A/D	PORCENTAJE DE ZONAS DE NO REBASE					
	0	20	40	60	80	100
50/50	1.00	1.00	1.00	1.00	1.00	1.00
60/40	0.90	0.89	0.87	0.86	0.85	0.83
70/30	0.82	0.80	0.78	0.76	0.74	0.71
80/20	0.75	0.72	0.70	0.67	0.65	0.63
90/10	0.69	0.66	0.64	0.61	0.58	0.56
100/100	0.64	0.61	0.58	0.56	0.53	0.50

Factor de corrección a la capacidad por efecto combinado del ancho de carril y berma

$$f_{cd}$$

ANCHO UTILIZABLE DE LA BERMA EN METROS	ANCHO DE CARRIL (m)				
	3.65	3.50	3.30	3.00	2.70
1.80	1.00	0.99	0.98	0.96	0.92
1.50	0.99	0.99	0.98	0.95	0.91
1.20	0.99	0.98	0.97	0.95	0.91
1.00	0.99	0.98	0.97	0.94	0.90
0.50	0.98	0.97	0.96	0.93	0.89
0.00	0.97	0.96	0.95	0.92	0.88

Factor de corrección a la capacidad por la presencia de vehículos pesados en pendientes

$$\text{ascendentes } f_p$$

PENDIENTE ASCENDENTE EN POR CIENTO	LONGITUD DE LA PENDIENTE (km)	PORCENTAJE DE VEHICULOS PESADOS					
		10	20	30	40	50	60
0	TODAS	0.95	0.90	0.87	0.84	0.81	0.78
1	0.5	0.95	0.90	0.87	0.84	0.81	0.78
	1.0	0.94	0.89	0.86	0.83	0.80	0.77
	1.5	0.93	0.88	0.85	0.82	0.80	0.77
	2.0	0.92	0.87	0.85	0.82	0.79	0.76
	3.0	0.91	0.87	0.84	0.82	0.79	0.76
	4.0	0.91	0.87	0.84	0.81	0.78	0.75
	≥5.0	0.90	0.87	0.83	0.81	0.78	0.75
2	0.5	0.94	0.90	0.85	0.83	0.80	0.77
	1.0	0.93	0.88	0.85	0.82	0.79	0.76
	1.5	0.92	0.88	0.84	0.81	0.79	0.76
	2.0	0.90	0.86	0.83	0.80	0.78	0.75
	3.0	0.88	0.85	0.82	0.79	0.76	0.73
	4.0	0.87	0.84	0.81	0.78	0.75	0.72
	≥5.0	0.86	0.83	0.80	0.77	0.74	0.72
3	0.5	0.94	0.89	0.84	0.81	0.78	0.75
	1.0	0.92	0.87	0.83	0.80	0.77	0.75
	1.5	0.89	0.85	0.81	0.78	0.75	0.73
	2.0	0.87	0.83	0.80	0.77	0.74	0.71
	3.0	0.86	0.82	0.79	0.76	0.73	0.70
	4.0	0.85	0.81	0.78	0.75	0.72	0.70
	≥5.0	0.84	0.80	0.78	0.75	0.72	0.69



PENDIENTE ASCENDENTE EN POR CIENTO	LONGITUD DE LA PENDIENTE (km)	PORCENTAJE DE VEHICULOS PESADOS					
		10	20	30	40	50	60
4	0.5	0.93	0.88	0.83	0.80	0.76	0.74
	1.0	0.89	0.83	0.80	0.77	0.74	0.71
	1.5	0.84	0.81	0.77	0.74	0.72	0.69
	2.0	0.83	0.79	0.76	0.73	0.70	0.68
	3.0	0.82	0.78	0.75	0.71	0.68	0.66
	4.0	0.81	0.77	0.74	0.71	0.68	0.65
	≥5.0	0.80	0.77	0.73	0.70	0.67	0.64
5	0.5	0.92	0.86	0.82	0.78	0.75	0.73
	1.0	0.85	0.80	0.77	0.74	0.71	0.69
	1.5	0.82	0.78	0.75	0.71	0.69	0.65
	2.0	0.80	0.77	0.73	0.70	0.67	0.63
	3.0	0.79	0.75	0.72	0.69	0.66	0.63
	4.0	0.78	0.74	0.71	0.68	0.65	0.62
	≥5.0	0.77	0.74	0.70	0.67	0.64	0.62
6	0.5	0.90	0.84	0.79	0.76	0.73	0.70
	1.0	0.81	0.77	0.73	0.70	0.67	0.65
	1.5	0.79	0.75	0.71	0.68	0.65	0.63
	2.0	0.77	0.74	0.70	0.67	0.64	0.62
	3.0	0.76	0.72	0.69	0.66	0.63	0.61
	4.0	0.75	0.72	0.68	0.65	0.63	0.60
	≥5.0	0.75	0.71	0.67	0.64	0.62	0.59
7	0.5	0.89	0.82	0.78	0.74	0.71	0.68
	1.0	0.78	0.74	0.71	0.67	0.64	0.61
	1.5	0.76	0.72	0.68	0.65	0.62	0.59
	2.0	0.74	0.70	0.67	0.63	0.60	0.57
	3.0	0.72	0.68	0.67	0.61	0.58	0.56
	4.0	0.71	0.67	0.64	0.60	0.57	0.55
	≥5.0	0.71	0.67	0.63	0.60	0.57	0.54
8	0.5	0.87	0.81	0.76	0.73	0.70	0.67
	1.0	0.76	0.72	0.68	0.65	0.62	0.59
	1.5	0.73	0.69	0.65	0.62	0.59	0.56
	2.0	0.71	0.67	0.63	0.60	0.57	0.53
	3.0	0.69	0.65	0.61	0.58	0.55	0.53
	4.0	0.68	0.64	0.60	0.57	0.54	0.52
	≥5.0	0.67	0.63	0.60	0.56	0.53	0.51
9	0.5	0.86	0.79	0.74	0.71	0.68	0.65
	1.0	0.74	0.70	0.67	0.64	0.60	0.58
	1.5	0.71	0.67	0.64	0.60	0.57	0.55
	2.0	0.70	0.66	0.62	0.59	0.56	0.53
	3.0	0.68	0.64	0.60	0.57	0.54	0.51
	4.0	0.67	0.63	0.59	0.56	0.53	0.50
	≥5.0	0.66	0.62	0.58	0.55	0.52	0.50
10	0.5	0.83	0.76	0.72	0.68	0.65	0.59
	1.0	0.70	0.66	0.62	0.59	0.56	0.52
	1.5	0.68	0.64	0.61	0.58	0.55	0.50
	2.0	0.66	0.62	0.58	0.55	0.52	0.48
	3.0	0.65	0.61	0.57	0.54	0.51	0.47
	4.0	0.64	0.60	0.56	0.53	0.50	0.46
	≥5.0	0.63	0.59	0.55	0.52	0.49	0.45
11	0.5	0.79	0.72	0.68	0.65	0.62	0.59
	1.0	0.69	0.65	0.61	0.58	0.55	0.52
	1.5	0.66	0.62	0.58	0.55	0.52	0.50
	2.0	0.64	0.60	0.57	0.54	0.51	0.48
	3.0	0.63	0.59	0.55	0.52	0.49	0.47
	4.0	0.62	0.58	0.54	0.51	0.48	0.46
	≥5.0	0.61	0.57	0.53	0.50	0.47	0.45
12	0.5	0.77	0.69	0.65	0.62	0.59	0.56
	1.0	0.66	0.62	0.59	0.55	0.52	0.50
	1.5	0.64	0.60	0.56	0.53	0.50	0.48
	2.0	0.62	0.58	0.55	0.52	0.49	0.46
	3.0	0.61	0.57	0.53	0.50	0.48	0.45
	4.0	0.60	0.56	0.53	0.49	0.47	0.44
	≥5.0	0.59	0.55	0.52	0.49	0.46	0.43

$$C = 3200 * 0.98 * 0.99 * 0.99 * 0.76$$

$$C = 2335.93$$

$$C = 2335 \text{ Veh/hr}$$

<b>Nivel de servicio</b>	<b>Descripción de flujo vehicular</b>	<b>Factor</b>
A	Flujo libre	0
B	Flujo estable	$\leq 0.1$
C	Flujo estable	$\leq 0.3$
D	Prox. a flujo inestable	$\leq 0.7$
E	Flujo inestable	= 1
F	Flujo inestable	> 1

### **Nivel de servicio**

$$NS = \frac{\text{Volumen}}{\text{capacidad}} = \frac{4602}{2335}$$

$$NS = 1.97$$

$$NS = F = \text{Flujo inestable}$$



**Nombre del tramo:** Carretera San Mateo – Sella (Monte Méndez - Barrio El Taco)

**Datos**

ancho total = 7 m

ancho de carril = 3.5 m

ancho de berma = 0.5 m

cota = 1991 - 1962

longitud = 1000 m

pendiente = 2.9 %

aforo vehicular tramo 1 (Carretera San Mateo – Sella (Monte Méndez - Barrio El Taco) ) de ida														
	6:00 - 7:00	7:00 - 8:00	8:00 - 9:00	9:00 - 10:00	10:00 - 11:00	11:00 - 12:00	12:00 - 13:00	13:00 - 14:00	14:00 - 15:00	15:00 - 16:00	16:00 - 17:00	17:00 - 18:00	18:00 - 19:00	19:00 - 20:00
lunes	38	35	39	27	20	24	17	24	28	23	16	24	31	26
martes	35	32	36	25	22	26	20	26	31	26	19	27	28	23
miércoles	33	43	33	27	19	28	25	22	33	29	17	23	27	25
jueves	38	49	32	21	25	22	22	28	25	30	20	25	30	21
viernes	35	52	38	32	34	30	28	33	29	36	18	29	36	23
sabado	32	27	49	38	54	32	38	45	45	48	53	23	53	48
domingo	29	23	47	35	49	29	34	47	42	45	50	20	49	42

aforo vehicular tramo 1 (Carretera San Mateo – Sella (Monte Méndez - Barrio El Taco) ) de vuelta														
	6:00 - 7:00	7:00 - 8:00	8:00 - 9:00	9:00 - 10:00	10:00 - 11:00	11:00 - 12:00	12:00 - 13:00	13:00 - 14:00	14:00 - 15:00	15:00 - 16:00	16:00 - 17:00	17:00 - 18:00	18:00 - 19:00	19:00 - 20:00
lunes	35	29	42	27	21	25	22	17	24	39	30	28	37	24
martes	30	26	38	27	23	28	24	20	26	37	32	31	33	27
miércoles	26	30	37	29	25	30	22	18	25	34	29	28	30	23
jueves	28	25	34	25	28	30	33	25	22	27	19	26	32	25
viernes	32	29	31	28	32	29	31	23	20	33	22	32	41	20
sabado	31	33	33	37	36	24	47	32	27	35	44	41	61	56
domingo	28	32	29	31	33	20	44	30	24	31	40	38	53	49

Carretera San Mateo – Sella (Monte Méndez - Barrio El Taco)							
Aforo vehicular durante una semana							
Días	Lunes	Martes	Miercoles	Jueves	Viernes	Sabado	Domingo
Total de ida	372	376	384	388	453	585	541
Total de vuelta	400	402	386	379	403	537	482
Adoptado	585						

Volumen = 585 veh

### Capacidad real

$$C = 3200 * f_{pe} * f_d * f_{cd} * f_p$$

C = Capacidad real

$f_{pe}$  = Factor de correlación a la capacidad por pendiente

$f_d$  = Factor por distribución por sentidos y zonas de no rebase

$f_{cd}$  = Factor por ancho de carril y berma

$f_p$  = factor por presencia de vehículos pesados

$$C = 3200 * 0.97 * 0.97 * 0.97 * 0.83$$

$$C = 2424.06$$

$$C = 2424 \text{ Veh/hr}$$

### Nivel de servicio

$$NS = \frac{\text{Volumen}}{\text{capacidad}} = \frac{585}{2424}$$

$$NS = 0.24$$

$NS = C = \text{Flujo inestable}$

Nivel de servicio	Descripción de flujo vehicular	Factor
A	Flujo libre	0
B	Flujo estable	$\leq 0.1$
C	Flujo estable	$\leq 0.3$
D	Prox. a flujo inestable	$\leq 0.7$
E	Flujo inestable	= 1
F	Flujo inestable	> 1

**Nombre del tramo: Ruta Nacional 1 (Cruce Calamuchita – Entrada a Muturayo)**

**Datos**

ancho total = 7.5 m

ancho de carril = 3.75 m

ancho de berma = 1 m

cota = 1724 - 1680

longitud = 1000 m

pendiente = 4.4 %

aforo vehicular tramo 1 (Ruta Nacional 1 (Cruce Calamuchita – Entrada a Muturayo)) de ida														
	6:00 - 7:00	7:00 - 8:00	8:00 - 9:00	9:00 - 10:00	10:00 - 11:00	11:00 - 12:00	12:00 - 13:00	13:00 - 14:00	14:00 - 15:00	15:00 - 16:00	16:00 - 17:00	17:00 - 18:00	18:00 - 19:00	19:00 - 20:00
lunes	45	122	77	71	73	85	87	68	74	75	89	98	85	85
martes	41	115	78	67	75	80	82	70	76	72	85	92	88	83
miercoles	43	118	85	77	75	90	87	68	82	69	89	100	92	88
jueves	45	122	82	76	72	88	85	73	80	70	87	98	85	90
viernes	51	108	76	78	67	79	72	80	78	88	94	103	83	98
sabado	65	51	47	63	60	58	68	76	73	85	132	95	87	95
domingo	50	42	48	59	57	53	62	72	67	77	113	98	89	92

aforo vehicular tramo 1 (Ruta Nacional 1 (Cruce Calamuchita – Entrada a Muturayo)) de vuelta														
	6:00 - 7:00	7:00 - 8:00	8:00 - 9:00	9:00 - 10:00	10:00 - 11:00	11:00 - 12:00	12:00 - 13:00	13:00 - 14:00	14:00 - 15:00	15:00 - 16:00	16:00 - 17:00	17:00 - 18:00	18:00 - 19:00	19:00 - 20:00
lunes	70	111	88	79	82	76	81	59	82	65	85	100	97	90
martes	62	106	85	72	84	77	78	62	79	68	80	95	90	87
miercoles	67	101	80	79	82	86	91	84	85	72	92	101	95	91
jueves	68	110	77	81	77	93	88	76	83	75	90	96	89	92
viernes	72	118	86	79	71	89	78	72	80	87	96	99	87	96
sabado	86	122	145	111	98	80	57	63	70	98	80	85	93	82
domingo	98	114	120	113	93	84	64	52	56	92	84	87	91	86

Ruta Nacional 1 (Cruce Calamuchita – Entrada a Muturayo)							
Aforo vehicular durante una semana							
Dias	Lunes	Martes	Miercoles	Jueves	Viernes	Sabado	Domingo
Total de ida	1134	1104	1163	1153	1155	1055	979
Total de vuelta	1165	1125	1206	1195	1210	1270	1234
Adoptado	1270						

**Volumen** = 1270 Veh

### Capacidad real

$$C = 3200 * f_{pe} * f_d * f_{cd} * f_p$$

C = Capacidad real

$f_{pe}$  = Factor de correlación a la capacidad por pendiente

$f_d$  = Factor por distribución por sentidos y zonas de no rebase

$f_{cd}$  = Factor por ancho de carril y berma

$f_p$  = factor por presencia de vehículos pesados

$$C = 3200 * 0.96 * 1 * 0.99 * 0.73$$

$$C = 2220.134$$

$$C = 2220 \text{ Veh/hr}$$

### Nivel de servicio

$$NS = \frac{\text{Volumen}}{\text{capacidad}} = \frac{1270}{2220}$$

$$NS = 0.57$$

$NS = D = \text{Proximo a Flujo inestable}$

Nivel de servicio	Descripción de flujo vehicular	Factor
A	Flujo libre	0
B	Flujo estable	$\leq 0.1$
C	Flujo estable	$\leq 0.3$
D	Prox. a flujo inestable	$\leq 0.7$
E	Flujo inestable	= 1
F	Flujo inestable	> 1

**ANEXO I**  
**PRECIOS UNITARIOS**

<b>ANALISIS DE PRECIOS UNITARIOS</b>					
Proyecto: EVALUACIÓN DE METODOLOGÍAS PARA DETERMINAR EL IRI EN PAVIMENTOS FLEXIBLES Y LA INFLUENCIA EN EL NIVEL DE SERVICIO				ITEM N°	1
Actividad : Método Mira y nivel de ingeniero		Cantidad : 1.00			
Unidad : ml		Moneda . Bs			
Descripcion	Unidad	Cantidad o Rendimiento	Precio Unitario	Costo Total	
<b>1 Materiales</b>					
1					
2					
3					
4					
5					
<b>Total Materiales</b>					0.00
<b>2 Mano de Obra</b>					
1	Topógrafo	hr	0.02	25.00	0.50
2	Ayudantes	hr	0.02	18.75	0.38
3					
<b>Sub Total Mano de Obra</b>					0.875
Cargas Sociales 55% del sub total M. O.					0.48
Impuestos IVA M.O. = (14,94% del Sub Total de M. O. + Cargas Sociales)					0.20
<b>Total Mano de Obra</b>					1.56
<b>3 Equipo, Maquinaria y Herramientas</b>					
1	Nivel de ingeniero	hr	0.02	12.50	0.25
2					0
3					0
4					0
5					0
Herramientas Menores 5 % del total mano de obra					0.08
<b>Total Eq, Maq. y Herr.</b>					0.33
<b>4 Gastos Generales y Administrativos</b>					
Gastos Generales 10% (1+2+3)					0.19
<b>5 Utilidad</b>					
Utilidad 10% (1+2+3+4)					0.21
<b>6 Impuestos</b>					
Impuestos I. T. 3,09% (1+2+3+4+5)					0.07
<b>Total Item Precio Unitario</b>					<b>2.35</b>

<b>ANALISIS DE PRECIOS UNITARIOS</b>				
Proyecto: EVALUACIÓN DE METODOLOGÍAS PARA DETERMINAR EL IRI EN PAVIMENTOS FLEXIBLES Y LA INFLUENCIA EN EL NIVEL DE SERVICIO			ITEM N°	2
Actividad : Método rugosímetro de Merlín		Cantidad : 1.00		
Unidad : ml		Moneda . Bs		
Descripcion	Unidad	Cantidad o Rendimiento	Precio Unitario	Costo Total
<b>1 Materiales</b>				
1				
2				
3				
4				
5				
<b>Total Materiales</b>				0.00
<b>2 Mano de Obra</b>				
1	Auxiliar de lab de asfaltos (equipo de merlín)	hr	0.001	21.43
2	Ayudantes	hr	0.001	10.00
3				0.00
4				0.00
5				
<b>Sub Total Mano de Obra</b>				0.03
Cargas Sociales 55% del sub total M. O.				0.02
Impuestos IVA M.O. = (14,94% del Sub Total de M. O. + Cargas Sociales)				0.01
<b>Total Mano de Obra</b>				0.06
<b>3 Equipo, Maquinaria y Herramientas</b>				
1	Rugosímetro de merlín	hr	0.001	20.00
2				
3				
4				
5				
Herramientas Menores 5 % de la mano de obra				0.00
<b>Total Eq, Maq. y Herr.</b>				0.02
<b>4 Gastos Generales y Administrativos</b>				
Gastos Generales 10% (1+2+3)				0.01
<b>5 Utilidad</b>				
Utilidad 10% (1+2+3+4)				0.01
<b>6 Impuestos</b>				
Impuestos I. T. 3,09% (1+2+3+4+5)				0.00
<b>Total Item Precio Unitario</b>				<b>0.10</b>

<b>ANALISIS DE PRECIOS UNITARIOS</b>					
Proyecto: EVALUACIÓN DE METODOLOGÍAS PARA DETERMINAR EL IRI EN PAVIMENTOS FLEXIBLES Y LA INFLUENCIA EN EL NIVEL DE SERVICIO			ITEM N°	<b>3</b>	
Actividad : Aplicación ROADROID		Cantidad : 1.00			
Unidad : <b>km</b>		Moneda . Bs			
Descripcion	Unidad	Cantidad o Rendimiento	Precio Unitario	Costo Total	
<b>1 Materiales</b>					
1	Licencia ROADROID	Dia	1	11.31	11.31
2					
3					
4					
5					
6					
<b>Total Materiales</b>				<b>11.31</b>	
<b>2 Mano de Obra</b>					
1	Conductor	hr	0.05	10.00	0.50
<b>Sub Total Mano de Obra</b>				<b>0.50</b>	
Cargas Sociales 55% del sub total M. O.				0.28	
Impuestos IVA M.O. = (14,94% del Sub Total de M. O. + Cargas Sociales)				0.12	
<b>Total Mano de Obra</b>				<b>0.89</b>	
<b>3 Equipo, Maquinaria y Herramientas</b>					
1	Vehiculo Hilux 4x4	hr	0.05	50.00	2.50
2	Porta celular tipo montaje de ventana	Pza	1.00	35.00	35.00
3					
4					
5					
Herramientas Menores 5 % de la mano de obra				0.04	
<b>Total Eq, Maq. y Herr.</b>				<b>37.54</b>	
<b>4 Gastos Generales y Administrativos</b>					
Gastos Generales 10% (1+2+3)				4.97	
<b>5 Utilidad</b>					
Utilidad 10% (1+2+3+4)				5.47	
<b>6 Impuestos</b>					
Impuestos I. T. 3,09% (1+2+3+4+5)				1.86	
<b>Total Item Precio Unitario</b>				<b>62.05</b>	



## **PRESUPUESTO TOTAL**

**Proyecto: EVALUACIÓN DE METODOLOGÍAS PARA DETERMINAR EL IRI EN PAVIMENTOS FLEXIBLES Y LA INFLUENCIA EN EL NIVEL DE SERVICIO**

<b>ITEM N°</b>	<b>DESCRIPCION</b>	<b>UNIDAD</b>	<b>CANTIDAD</b>	<b>P. U. Total</b>	<b>COSTO P/ITEM</b>
1	Método mira y nivel de ingeniero	ml	1000.00	2.35	2,353.60
2	Rugosímetro de Merlín	ml	10000.00	0.10	982.87
3	Aplicación ROADROID	km	10.00	62.05	620.52

**COSTO TOTAL(Bs) = 3,956.99**

**COSTO TOTAL EN**

**\$us. = 591.48**