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VISIBILITY LANDMARK PLOTTER SOFTWARE MODULE FOR AERODROMES

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Executive Summary

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Abstract

India Meteorological Department (IMD) is the national agency which is responsible in all matters related to provision of Meteorological support to aviation in India. A Polar diagram of Visibility landmarks is a mandatory record which is prepared using standard procedures at aerodromes. Visibility Landmarks play an important role at aerodromes, especially during bad weather to estimate the general visibility. These landmarks are plotted on a polar diagram centered around Air Traffic Control Tower. Certain landmarks may become obscured by natural vegetation or man-made structures. Therefore, it is essential to regularly update and plot these landmarks. However, manually completing these tasks can be time-consuming and subjective. To address this issue, a web-based application **"Visibility Landmark Plotter"** is developed in the Electronic-Laboratory, Climate Research Services, IMD, Pune. This report describes the operation of the application and comparison of its output with manually prepared polar diagrams of a few aerodromes. This application allows easy plotting of visibility landmarks, ensuring uniformity in the plotted polar diagram at all airports throughout India.

1. Introduction and Purpose

The Visibility Landmark Plotter is developed to automate and standardize the process of plotting of visibility landmarks at airports, addressing the challenges of manual updates and subjective assessments. Visibility landmarks are crucial for determining general visibility, especially in adverse weather conditions. At airports, these landmarks are represented on a polar diagram centred on the Air Traffic Control (ATC) Tower, which can become obstructed by new structures or vegetation over time. This web-based application offers a streamlined and objective approach to plot these landmarks. It ensures consistency and accuracy in visibility assessments among all Indian airports.

The tool is designed to meet the specific needs of airport by configuring various parameters such as runway orientation, azimuth, distance, and geographical coordinates. This customised software module enables the generation of precise and tailored diagrams for different operational environments. Users can select between short-range and long-range visibility landmarks, covering different radii from the ATC Tower. Additionally, the application provides options to adjust marker and font sizes, enhancing readability and usability. By leveraging this application, it is ensured that visibility landmark diagrams are consistently updated and uniformly presented, ultimately improving the reliability of visibility assessments.

2. Description of the Software

The **Visibility Landmark Plotter** is designed to be highly customizable, catering to the specific needs of officials in the Met Briefing Room at various airports. Users input parameters such as runway orientation, azimuth, distance, latitude, longitude, and more, allowing for precise plotting of diagrams tailored to the operational environment. By incorporating user-defined data, the plotter ensures that thegenerated diagrams accurately reflect the landmarks pertinent to the aerodrome under observation.

3. Procedure

The parameters to be fed to the software module are as follows (as shown in Figure. 1)

a) ICAO**:** The unique ICAO code by which the airport is identified.

b) ATC Latitude: The latitude coordinates of the location of the ATC tower.

c) ATC Longitude: The longitude coordinates of the location of the ATC tower.

d) Plot Type: This parameter has two options- "**Short" and "Long"**

   i. Short Plot type refers to Short Range Visibility Landmarks, i.e. Landmarks which fall under the radius of 2000m from the ATC tower.

   ii. Long Plot type refers to Long Range Visibility Landmarks, i.e. Landmarks which fall under the radius of 10000m from the ATC tower.

e) Circle Size: This is the size of the marker from which the specific landmarks are identified.The default value is 10.

f) Font Size: This is the font-size of the landmark numbers. The default size is 10.

g) User also has to input other parameters like Landmark names, Azimuth, Distance, and Visible on day and /or night.

h) Once the user successfully fills all the input parameters, user has to click the submit button.

i) A table containing the filled data will get displayed, user can verify the details entered, or if required, correct it, and resubmit the entries. After final verification, user can proceed to generate the plot by marking the check box regarding authenticity of the data and then clicking the "GENERATE" button.

j) After clicking GENERATE button, the plot will get generated in a new tab. If still any corrections in the data is required, user can go back to "Landmark Entry" tab, and follow the previous steps.

k) If plot generated is satisfactory then, user can click the "Generate PDF". A pdf of the plot would get auto-downloaded, and a copy of the same would get automatically stored in the Centralized server.

4. Types of Plots

There are two types of Visibility Landmark plots.

a) Long Range- Beyond 2000m radius from the ATC tower. (refer Figure 2)
b) Short Range- Up to 2000m radius from the ATC tower. (refer Figure 3)

5. Features

a) Airports with more than one runway can also benefit by the Visibility Landmark Plotter, using the **Add Runway** option.
b) Multiple landmarks can be added, which accept parameters like Azimuth, Distance, Longitude, and Latitude.
c) Landmarks visible during Day & Night, only during Day and only during Night can be differentiated.
    i. Blue color marker for Day and Night Visible Landmarks.
    ii. Red color marker for only Day Visible Landmarks.
    iii. Black color marker for only Night Visible Landmarks.
d) The form can be edited multiple times even after pressing the **Submit** button. The plot will be generated only after pressing the **Generate** button. The user can verify the details by viewing the table generated below after submitting the form.
e) After the generation of the plot, if **Generate PDF** button is clicked, a confirmation dialogbox will get displayed, and then a pdf will get downloaded and a copy of the same pdf will get stored in the centralized server.
f) Multiple users can use the website at the same time without any interference.
g) The date of generation of the plot is specified. It helps in the timely update and creation of new plots as and when required.

6. Security

a) The authenticity of the data can be assured using the **QR code in the generated plot**. This ensures that the plot data can be secured from any manipulations at a later stage.
b) **A copy of the generated plot will be permanently stored in the centralized server.**
c) **The generated PDF will be approved by the designated authority.**
d) The Visitor Count functionality helps to keep a track on the number of users accessing the portal for the generation of the Landmark Plot.

7. Web Hosting

This web-based application requires hosting on a web server to ensure accessibility over the internet. It allows users to access its features and data remotely. This is a light weight software module, it can be deployed with basic hardware requirements

8. Comparisons / Case Studies

The existing plots and the plots generated using the Visibility Landmark Plotter for AMS Kadapa and AMS Mana are shown in Figure 4 to Figure 9 for reference. It is found that the patterns of the existing plots of each station is different and non-uniform.

9. Advantages

a) The Visibility Landmark Plotter helps in generation of the Landmark Plots with better accuracy and helps in eliminating manual errors.
b) It helps in the virtual storage of the plot since it generates a pdf of the plot- at both client and server end, which can be stored for future reference.
c) The Long-Range and Short-Range Plot features help the user to generate the plot in a customized way.

10. Conclusion

The development of the Visibility Landmark Plotter marks a significant advancement in automating the process of updating and plotting visibility landmarks. This tool will ensure a higher level of precision and uniformity of Visibility Landmark Plots across all airports in India. The application minimizes human error and the subjectivity that often accompanies the manual plotting, providing a reliable and consistent method for landmark visualization. The ability to store generated plots in PDF format, at both client and server end, facilitates easy retrieval and archival for future use. Additionally, the option to create either short-range or long-range visibility diagrams offers flexibility, allowing users to tailor the outputs to their specific needs. Overall, this web-based tool significantly streamlines the plotting process, enhancing the accuracy and efficiency of visibility assessments at airports.

12. References

Standard Operational Procedure for Aviation Meteorology-https://mausam.imd .gov.in/ imd_latest/contents/pdf/aviation_sop.pdf

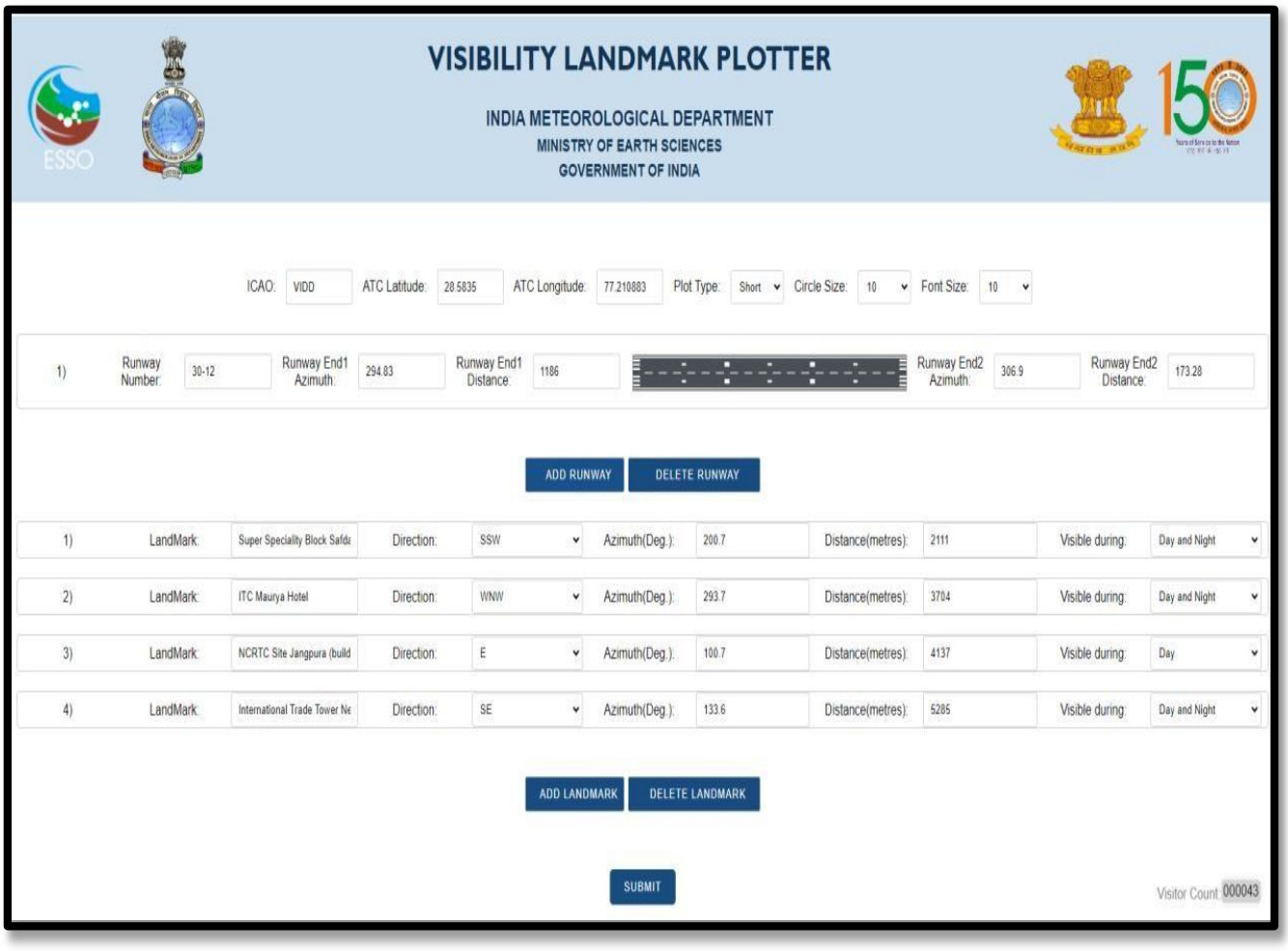
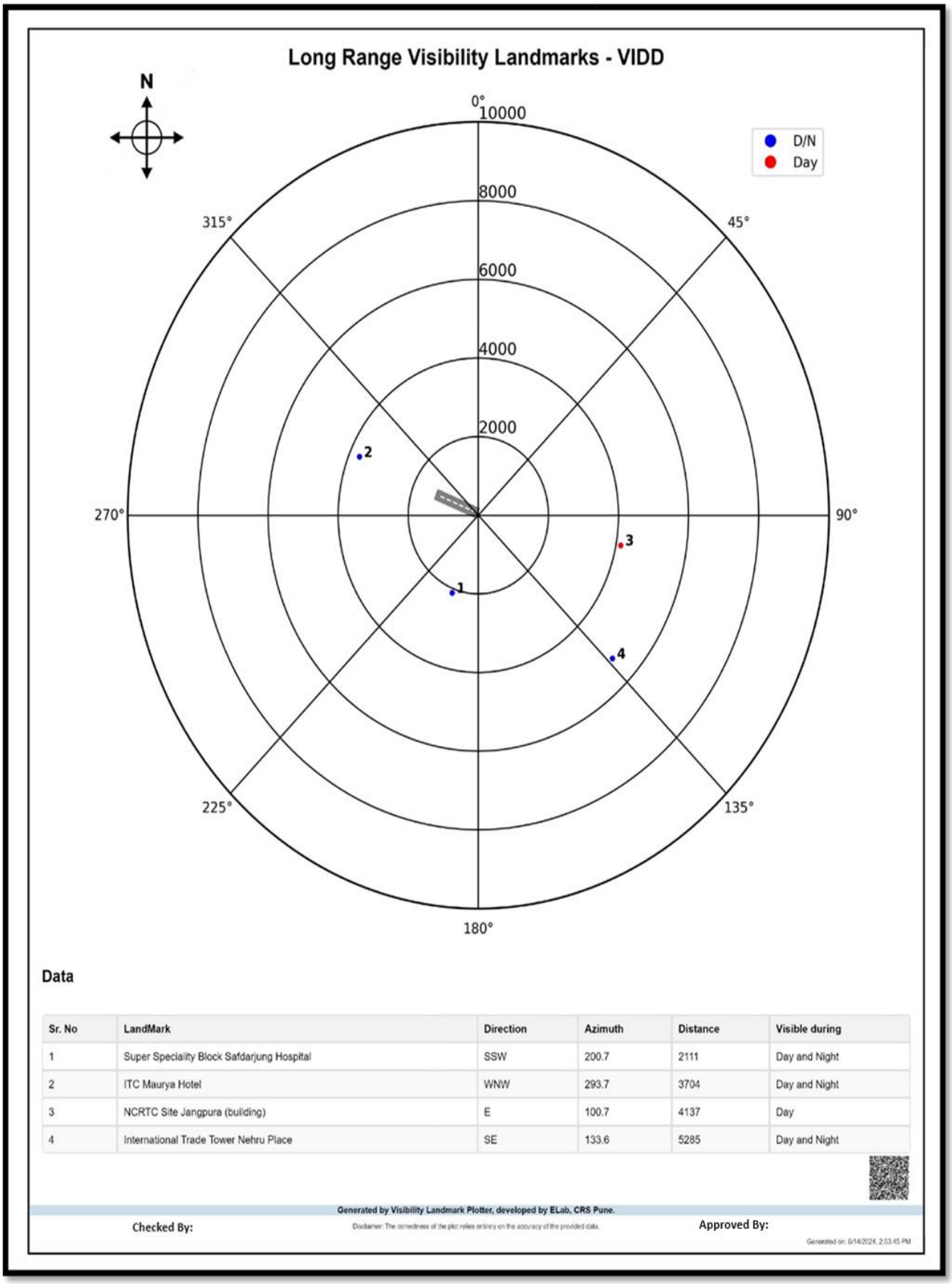


Figure.1 User input form which contains the entries to be filled by the user.



Data

Sr. No	LandMark	Direction	Azimuth	Distance	Visible during
1	Super Speciality Block Safdarjung Hospital	SSW	200.7	2111	Day and Night
2	ITC Maurya Hotel	WNW	293.7	3704	Day and Night
3	NCRTC Site Jangpura (building)	E	100.7	4137	Day
4	International Trade Tower Nehru Place	SE	133.6	5285	Day and Night

Generated by Visibility Landmark Plotter, developed by ELab, CRS Pune.

Checked By:

Disclaimer: The correctness of the plot relies entirely on the accuracy of the provided data.

Approved By:

Generated on: 6/14/2024, 2:53:45 PM

Figure. 2 Visibility Landmark Plot for Long Range generated from data filled in form in Figure.1

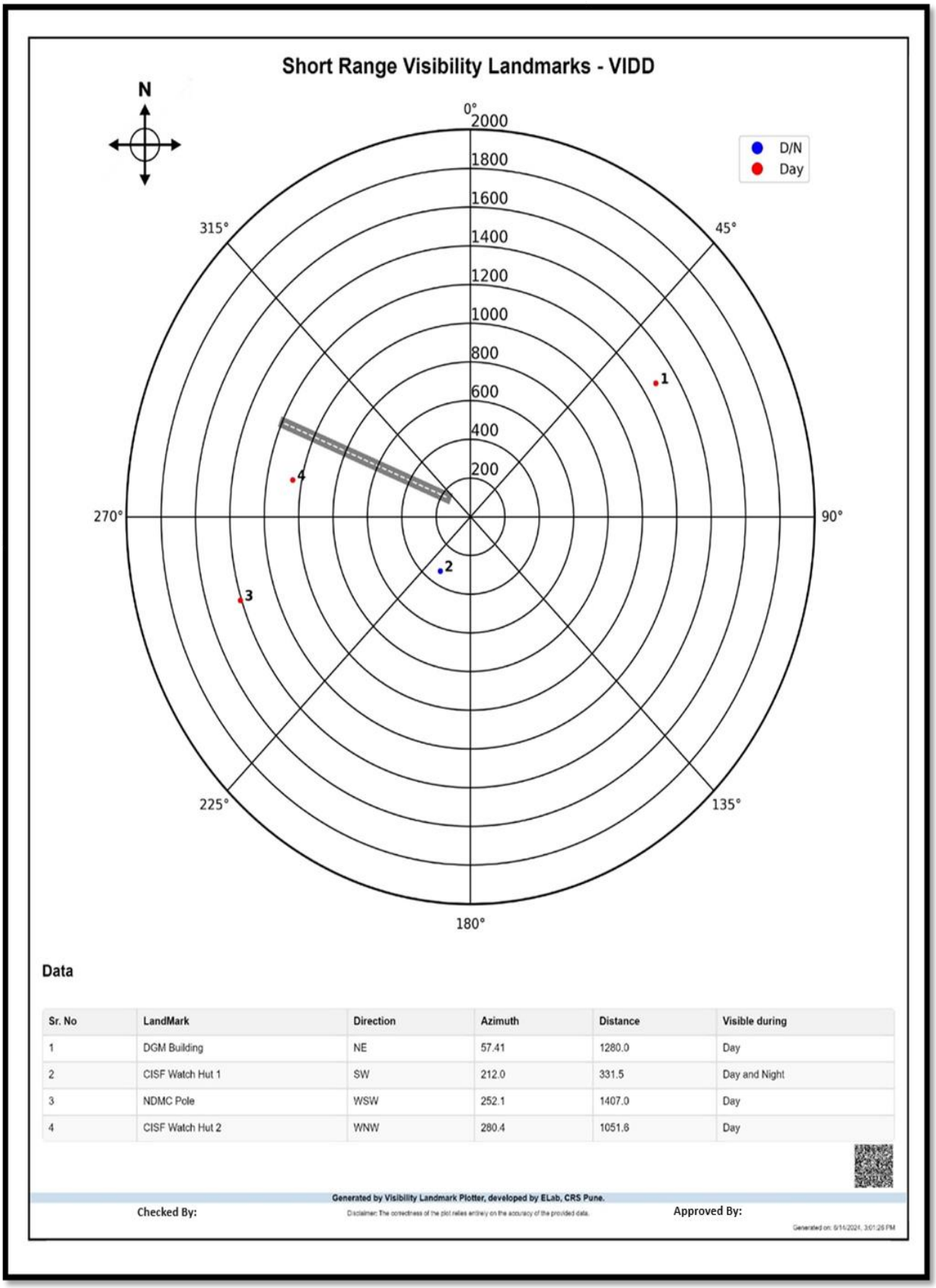
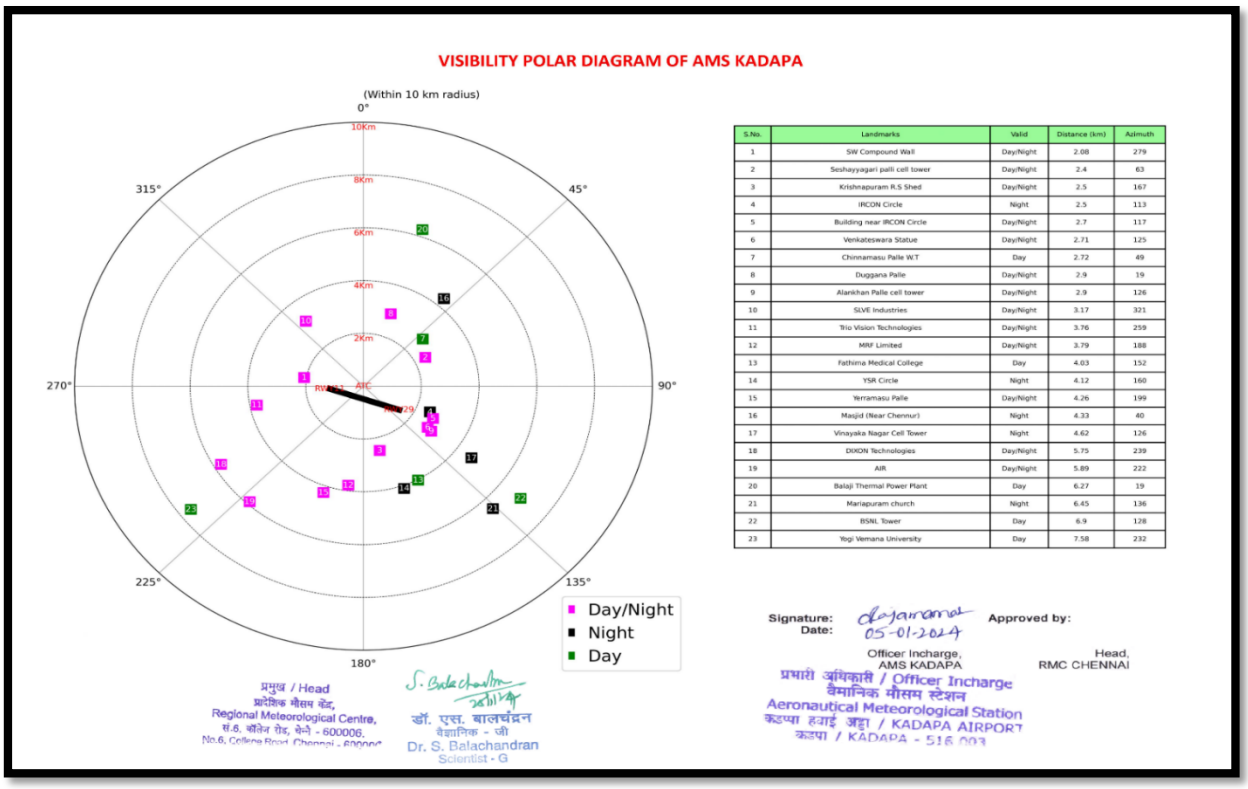
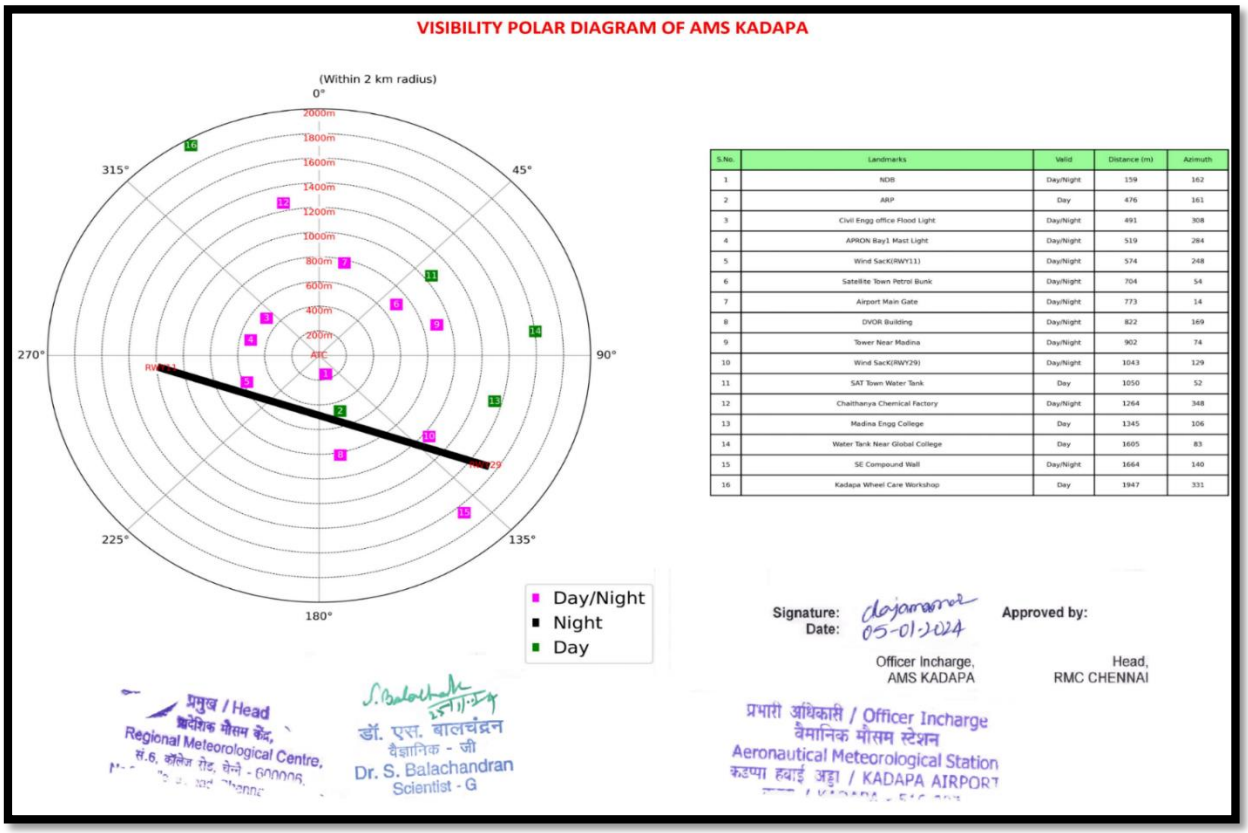


Figure. 3 Visibility Landmark Plot for Short Range generated from data filled in form in Figure. 1



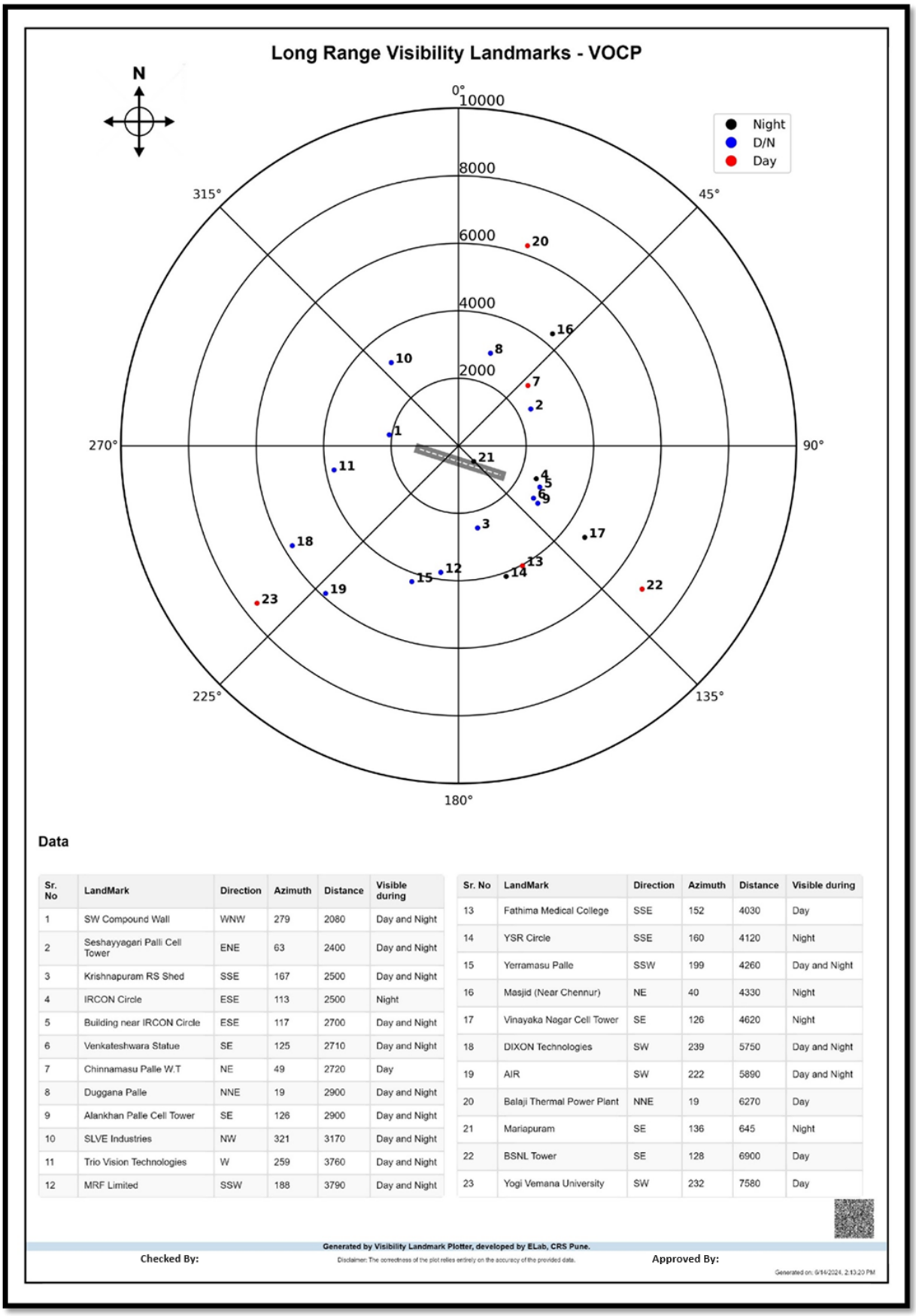
S.No.	Landmarks	Valid	Distance (km)	Azimuth
1	SW Compound Wall	Day/Night	2.08	279
2	Seshayyagari palli cell tower	Day/Night	2.4	63
3	Krishnapuram R.S Shed	Day/Night	2.5	167
4	IRCON Circle	Night	2.5	113
5	Building near IRCON Circle	Day/Night	2.7	117
6	Venkateswara Statue	Day/Night	2.71	125
7	Chinnamasu Palle WT	Day	2.72	49
8	Duggana Palle	Day/Night	2.9	19
9	Alanikhan Palle cell tower	Day/Night	2.9	126
10	SLVE Industries	Day/Night	3.17	321
11	Trio Vision Technologies	Day/Night	3.76	259
12	MRF Limited	Day/Night	3.79	188
13	Fathima Medical College	Day	4.03	152
14	YSR Circle	Night	4.12	160
15	Yerramasu Palle	Day/Night	4.26	199
16	Masjid (Near Chennur)	Night	4.33	40
17	Vinayaka Nagar Cell Tower	Night	4.62	126
18	DIXON Technologies	Day/Night	5.75	239
19	AIR	Day/Night	5.89	222
20	Balaji Thermal Power Plant	Day	6.27	19
21	Mariapuram church	Night	6.45	136
22	BSNL Tower	Day	6.9	128
23	Yogi Vemana University	Day	7.58	232

Figure. 4 Long Range Visibility Landmarks Polar Plot of AMS Kadapa (Existing Approved Plot)



S.No.	Landmarks	Valid	Distance (m)	Azimuth
1	NDB	Day/Night	159	162
2	ARP	Day	476	161
3	Civil Engg office Flood Light	Day/Night	491	308
4	APRON Bay1 Mast Light	Day/Night	519	284
5	Wind SacK(RWY11)	Day/Night	574	248
6	Satellite Town Petrol Bunk	Day/Night	704	54
7	Airport Main Gate	Day/Night	773	14
8	DVOR Building	Day/Night	822	169
9	Tower Near Madina	Day/Night	902	74
10	Wind SacK(RWY29)	Day/Night	1043	129
11	SAT Town Water Tank	Day	1050	52
12	Chaithanya Chemical Factory	Day/Night	1264	348
13	Madina Engg College	Day	1345	106
14	Water Tank Near Global College	Day	1605	83
15	SE Compound Wall	Day/Night	1664	140
16	Kadapa Wheel Care Workshop	Day	1947	331

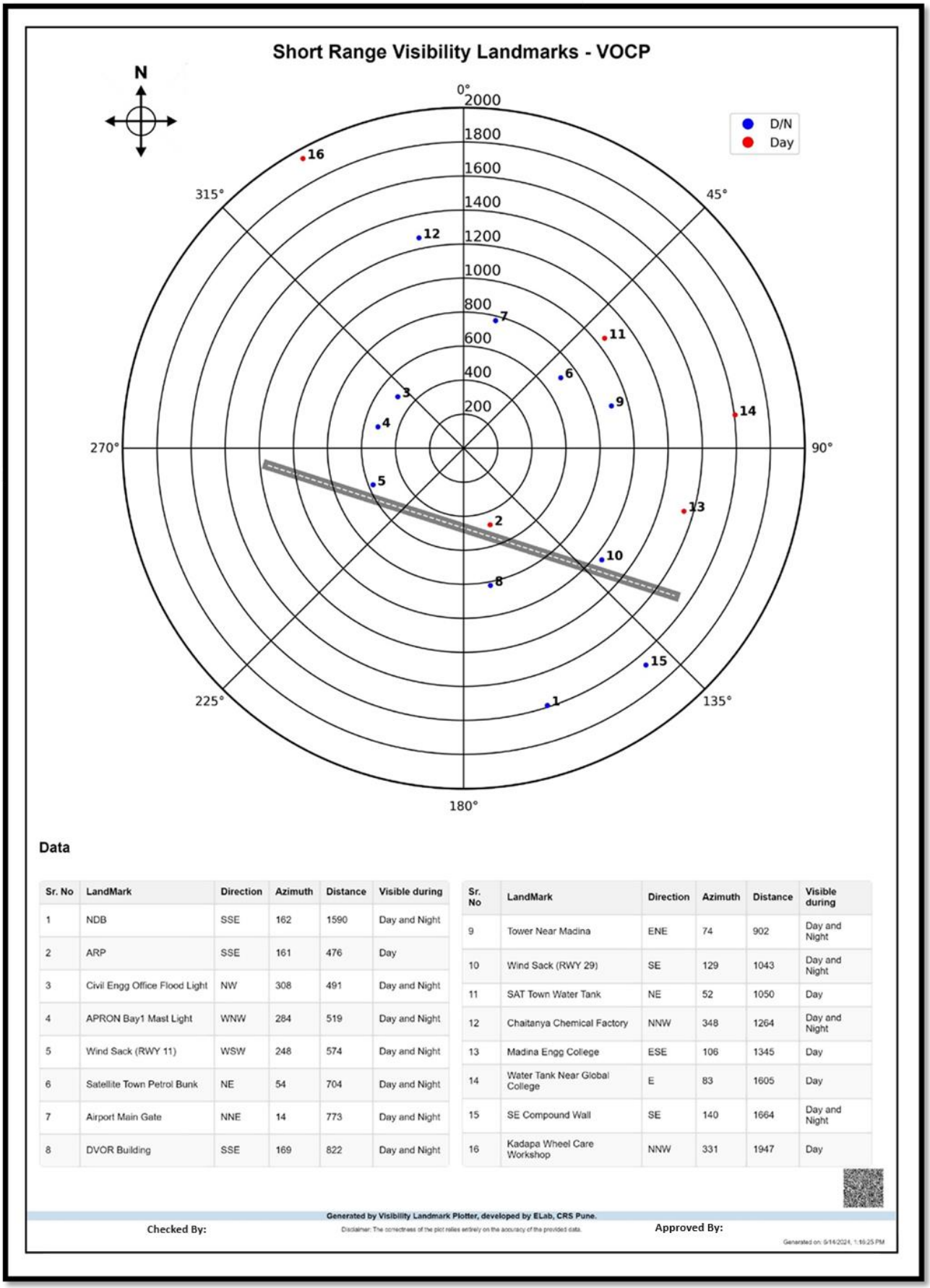
Figure. 5 **Short Range** Visibility Landmarks Polar Plot of AMS Kadapa (Existing Approved Plot)



Sr. No	LandMark	Direction	Azimuth	Distance	Visible during
1	SW Compound Wall	WNW	279	2080	Day and Night
2	Seshayyagari Palli Cell Tower	ENE	63	2400	Day and Night
3	Krishnapuram RS Shed	SSE	167	2500	Day and Night
4	IRCON Circle	ESE	113	2500	Night
5	Building near IRCON Circle	ESE	117	2700	Day and Night
6	Venkateshwara Statue	SE	125	2710	Day and Night
7	Chinnamasu Palle W.T	NE	49	2720	Day
8	Duggana Palle	NNE	19	2900	Day and Night
9	Alankhan Palle Cell Tower	SE	126	2900	Day and Night
10	SLVE Industries	NW	321	3170	Day and Night
11	Trio Vision Technologies	W	259	3760	Day and Night
12	MRF Limited	SSW	188	3790	Day and Night

Sr. No	LandMark	Direction	Azimuth	Distance	Visible during
13	Fathima Medical College	SSE	152	4030	Day
14	YSR Circle	SSE	160	4120	Night
15	Yerramasu Palle	SSW	199	4260	Day and Night
16	Masjid (Near Chennur)	NE	40	4330	Night
17	Vinayaka Nagar Cell Tower	SE	126	4620	Night
18	DIXON Technologies	SW	239	5750	Day and Night
19	AIR	SW	222	5890	Day and Night
20	Balaji Thermal Power Plant	NNE	19	6270	Day
21	Mariapuram	SE	136	645	Night
22	BSNL Tower	SE	128	6900	Day
23	Yogi Vemana University	SW	232	7580	Day

Figure. 6 **Long Range** plot generated using **Visibility Landmark Plotter Software Module** for AMS Kadapa.



Data

Sr. No	LandMark	Direction	Azimuth	Distance	Visible during
1	NDB	SSE	162	1590	Day and Night
2	ARP	SSE	161	476	Day
3	Civil Engg Office Flood Light	NW	308	491	Day and Night
4	APRON Bay1 Mast Light	WNW	284	519	Day and Night
5	Wind Sack (RWY 11)	WSW	248	574	Day and Night
6	Satellite Town Petrol Bunk	NE	54	704	Day and Night
7	Airport Main Gate	NNE	14	773	Day and Night
8	DVOR Building	SSE	169	822	Day and Night

Sr. No	LandMark	Direction	Azimuth	Distance	Visible during
9	Tower Near Madina	ENE	74	902	Day and Night
10	Wind Sack (RWY 29)	SE	129	1043	Day and Night
11	SAT Town Water Tank	NE	52	1050	Day
12	Chaitanya Chemical Factory	NNW	348	1264	Day and Night
13	Madina Engg College	ESE	106	1345	Day
14	Water Tank Near Global College	E	83	1605	Day
15	SE Compound Wall	SE	140	1664	Day and Night
16	Kadapa Wheel Care Workshop	NNW	331	1947	Day

Generated by Visibility Landmark Plotter, developed by ELab, CRS Pune.

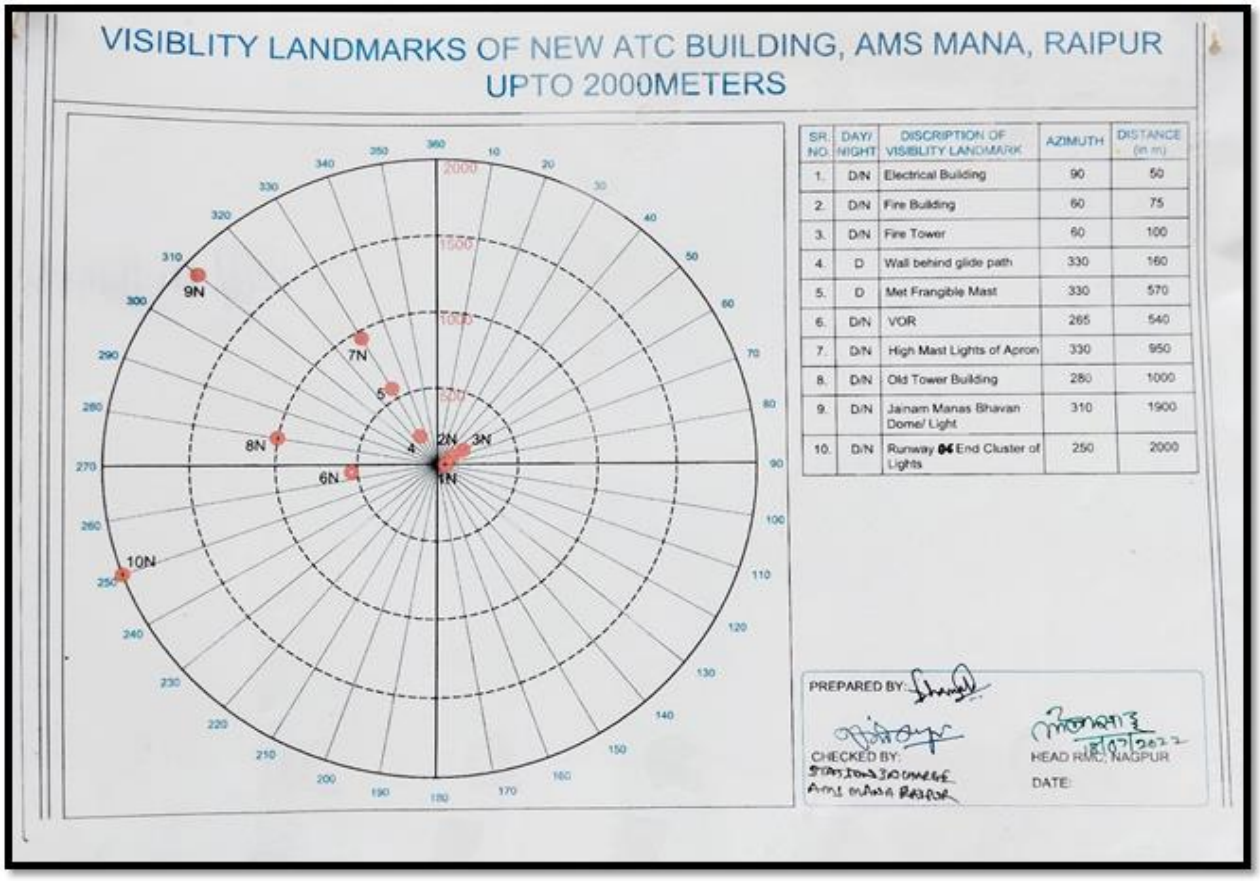
Checked By:

Disclaimer: The correctness of the plot relies entirely on the accuracy of the provided data.

Approved By:

Generated on: 6/14/2024, 1:16:25 PM

Figure. 7 **Short Range** plot generated using **Visibility Landmark Plotter Software Module** for AMS Kadapa



SR. NO.	DAY/ NIGHT	DISCRIPTION OF VISIBLITY LANDMARK	AZIMUTH	DISTANCE (in m)
1.	D/N	Electrical Building	90	50
2.	D/N	Fire Building	60	75
3.	D/N	Fire Tower	60	100
4.	D	Wall behind glide path	330	160
5.	D	Met Frangible Mast	330	570
6.	D/N	VOR	265	540
7.	D/N	High Mast Lights of Apron	330	950
8.	D/N	Old Tower Building	280	1000
9.	D/N	Jainam Manas Bhavan Dome/ Light	310	1900
10.	D/N	Runway 04 End Cluster of Lights	250	2000

Figure. 8 **Short Range** Visibility Landmarks Polar Plot of AMS Mana, Raipur (Existing Approved Plot)

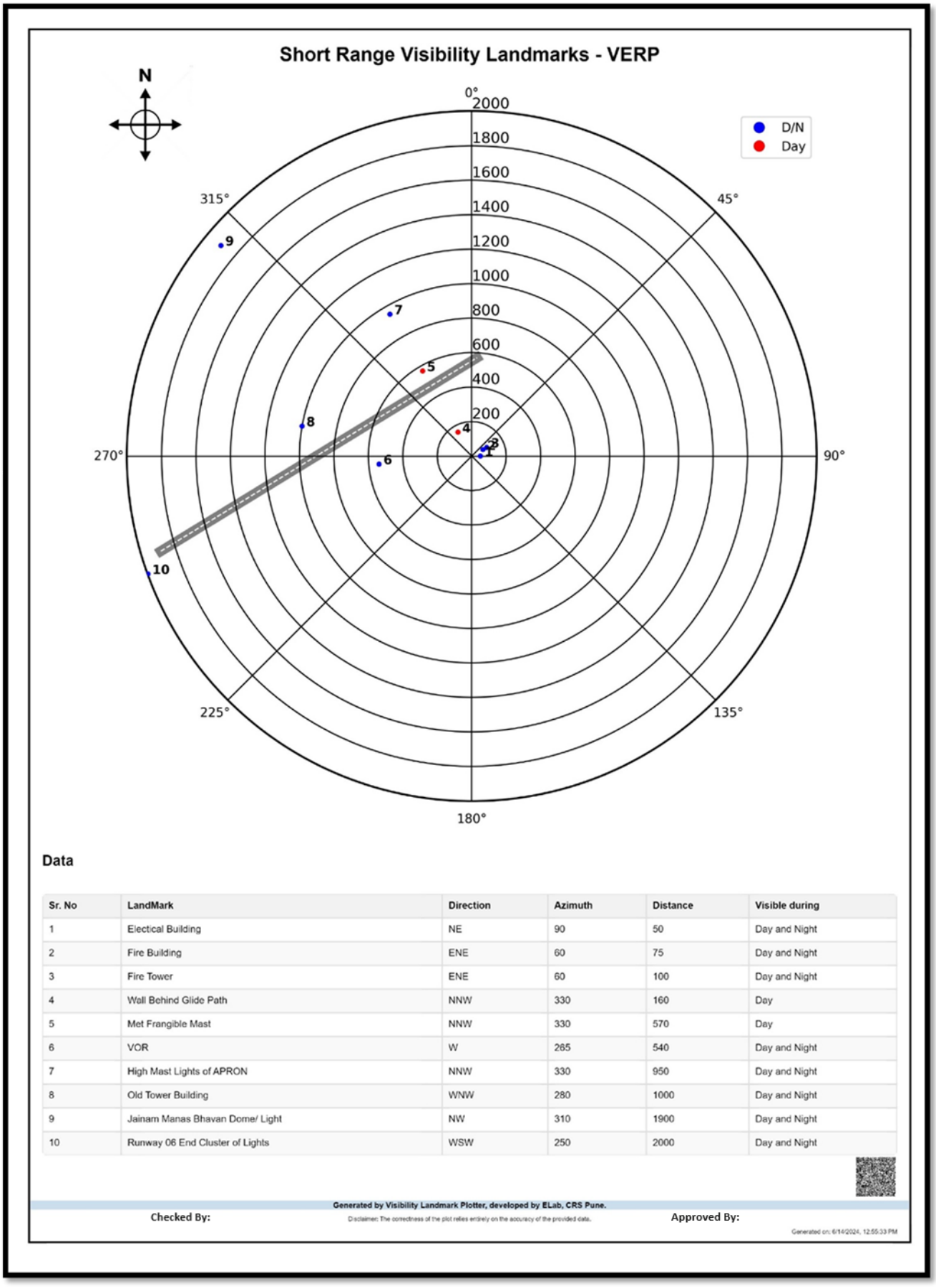


Figure. 9 **Short Range** plot generated using **Visibility Landmark Plotter Software Module** for AMS Mana Raipur