

Paris Session 2022



Design process by JEC-5101 and the practical application design of towers

PS1/Group 1: Design related, Q 1.7

Question 1.7 : Could the authors explain how these criteria would be actually used for new line construction? Whether tower at each location would be designed differently depending upon wind speed & its direction or optimum utilization of standard designs shall be done during spotting of towers considering directional wind maps & topography?

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1. JEC-5101 Features

➤ The structural features of the transmission tower that supports the overhead wire mean the wind direction impact significantly on the tower response and the action wind speed, in turn, is significantly affected by the topography and surface roughness. To rationalize the tower design, JEC adopts a design wind speed that takes wind direction into consideration.

➤ Wind load

- ✓ 8-directional basic wind speed map
- ✓ Topography and surface roughness
- ✓ Equivalent static wind load

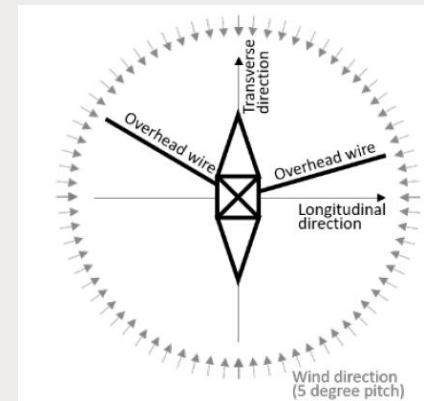
➤ Snow load

- ✓ Basic snow accretion map
- ✓ Topography and surface roughness
- ✓ Equivalent static wind load

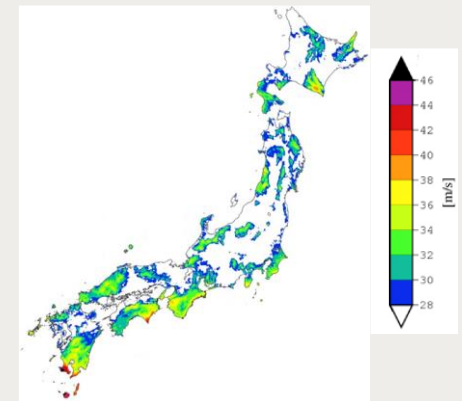
➤ Seismic load

- ✓ Basic acceleration map
- ✓ Layer shear force coefficient method

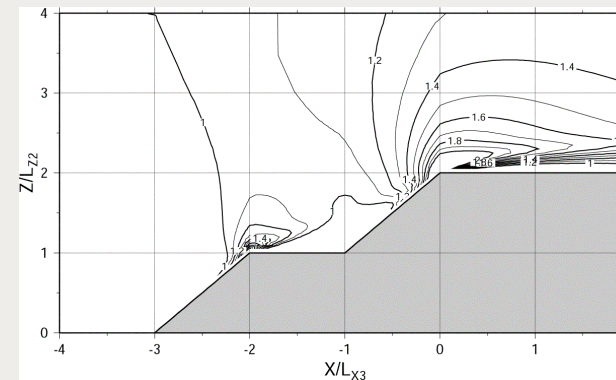
Group Discussion Meeting



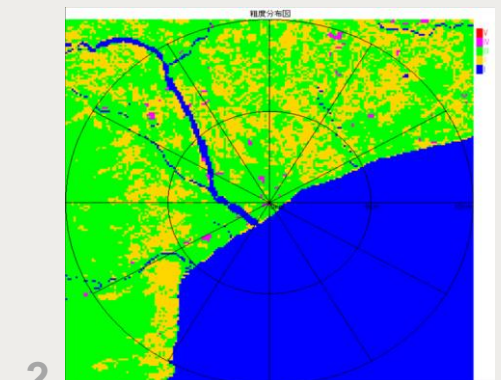
Directional design wind speed



Basic wind speed map



Wind Speed-up ratio by topography



Roughness evaluation

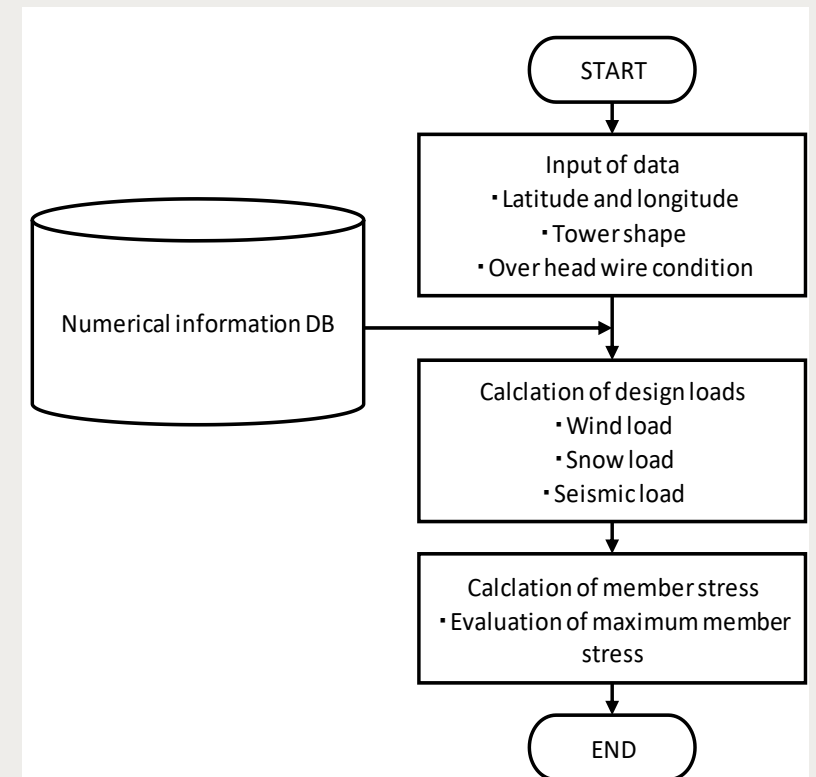
2. Design method according to JEC-5101

- The load is calculated based on the unique point information of the construction site using various pre-prepared numerical information databases.
- JEC is premised on computer design due to the use of a numerical database and the complexity of the tower design.
- TC-LOAD2 user support system has been developed.
 - ✓ Acquiring information from the database
 - ✓ Calculation the design load
 - ✓ Evaluation the stress of the tower members
- Tower members shall be selected to satisfy the required strength against the maximum value of member stress under all design conditions.

Group Discussion Meeting

Numerical information database to calculate the design load of JEC-5101

Database	Mesh size
8-directional basic wind speed map	5km
Elevation database	50m
Wind speed-up ratio database	100m
Land use database	5km
Basic snow accretion map	5km
Basic acceleration map	1km









Stress calculation flow by TC-LOAD2 (CRIEPI)

3. The application design of the towers in practice

- When constructing a new transmission line, **the total tower weight can be minimized** by designing each tower **under individual local conditions**. In particular, making the tower lighter would make transporting and assembling the members more affordable.
- However, this would be impractical in terms of **time and cost**, given the high number of towers to be designed and the time and effort required to manufacture.
- Accordingly, it is desirable to set a common tower type by examining the tower shape, including the arm and design load level (as determined by the load span, horizontal angle, etc.) and to apply multiple towers with a single type.
- Conversely, in JEC, the load and stress are evaluated according to **the conditions of each construction site and wind direction**, meaning the tower type at the member stress level has to be selected. Accordingly, as well as the abovementioned tower shape, **the tower member stress level** has to be evaluated and examined and the optimum tower type applied.

Example of tower type selection

Insulator	Shape	Type	Stress level	
Suspension	A	A1	Small	
		A2		
		A3		
		.		
		.	Large	
Tension	B	B1	Small	
		B2		
		B3		
		.		
		.	Large	
	C		C1	Small
			C2	
			C3	
			.	
			.	Large
G		G1	Small	
		G2		
		G3		
		.		
		.	Large	