



# Moodlakatte Institute of Technology, Kundapura

## Civil Engineering (CV)

Course Name : PAVEMENT DESIGN ( 18CV825 )

Class : Semester 8 A

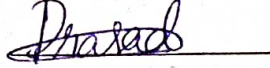
A handwritten signature in green ink, appearing to be 'Prasad Gaonkar', written over a faint circular stamp.

*Principal*

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Moodlakatte, Kundapura - 576217  
Udupi Dist., Karnataka

**Prof Prasad Gaonkar**  
**Assistant Professor,**  
**2022-23**

**1 . Faculty Details**

Name : Prof Prasad Gaonkar  
Qualification : M.Tech  
Department : CV  
Permanent Address : Jogi Mane, Kodlagadde Ankola Taluk, Ankola,  
581337, India  
Phone Number : 9481463493  
Email ID : prasad@mitkundapura.com  
Specimen Signature : 

  
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**2 . Course Allotted**

Allotted Duty	Course Title	Course Code
THEORY 1	PAVEMENT DESIGN	18CV825




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**HOD**



**3. Academic calendar 2022-23 ( Semester 8 )**

Date	Day	Event
13 Feb 2023	MONDAY	Term Start Date
13 Feb 2023	MONDAY	Commencement of 8th Semester Classes
18 Feb 2023	SATURDAY	MAHA SHIVARATHRI
16 Mar 2023	THURSDAY	8TH SEM FIRST IA
20 Mar 2023	MONDAY	VI SEM COMMENCEMENT
22 Mar 2023	WEDNESDAY	UGADI
3 Apr 2023	MONDAY	MAHAVIRA JAYANTHI
7 Apr 2023	FRIDAY	GOOD FRIDAY
13 Apr 2023	THURSDAY	8TH SEM 2ND IA
14 Apr 2023	FRIDAY	AMBEDKAR JAYANTHI
27 Apr 2023	THURSDAY	VI SEM FIRST IA
28 Apr 2023	FRIDAY	VI SEM FIRST IA
29 Apr 2023	SATURDAY	VI SEM FIRST IA
1 May 2023	MONDAY	MAY DAY
4 May 2023	THURSDAY	8TH SEM 3RD IA
13 May 2023	SATURDAY	LAST WORKING DAY FOR 8TH SEM
25 May 2023	THURSDAY	Commencement of II sem
1 Jun 2023	THURSDAY	VI SEM SECOND IA
2 Jun 2023	FRIDAY	VI SEM SECOND IA
3 Jun 2023	SATURDAY	1st SATURDAY
3 Jun 2023	SATURDAY	VI SEM SECOND IA
5 Jun 2023	MONDAY	IV SEM COMMENCEMENT
17 Jun 2023	SATURDAY	3rd SATURDAY



Date	Day	Event
29 Jun 2023	THURSDAY	BAKRID
1 Jul 2023	SATURDAY	1st SATURDAY
6 Jul 2023	THURSDAY	VI SEM THIRD IA
6 Jul 2023	THURSDAY	VI SEM THIRD IA
7 Jul 2023	FRIDAY	VI SEM THIRD IA
7 Jul 2023	FRIDAY	VI SEM THIRD IA
8 Jul 2023	SATURDAY	VI SEM THIRD IA
8 Jul 2023	SATURDAY	VI SEM THIRD IA
9 Jul 2023	SUNDAY	VI SEM THIRD IA
10 Jul 2023	MONDAY	VI SEM LAST WORKING DAY
10 Jul 2023	MONDAY	VI SEM THIRD IA
10 Jul 2023	MONDAY	I IA TENTATIVE
11 Jul 2023	TUESDAY	VI SEM THIRD IA
11 Jul 2023	TUESDAY	I IA TENTATIVE
12 Jul 2023	WEDNESDAY	VI SEM THIRD IA
12 Jul 2023	WEDNESDAY	I IA TENTATIVE
13 Jul 2023	THURSDAY	VI SEM THIRD IA
13 Jul 2023	THURSDAY	I IA TENTATIVE
14 Jul 2023	FRIDAY	I IA TENTATIVE
15 Jul 2023	SATURDAY	3rd SATURDAY
15 Jul 2023	SATURDAY	I IA TENTATIVE
16 Jul 2023	SUNDAY	I IA TENTATIVE
17 Jul 2023	MONDAY	I IA TENTATIVE
29 Jul 2023	SATURDAY	MOHARAM





Date	Day	Event
5 Aug 2023	SATURDAY	Term End Date
5 Aug 2023	SATURDAY	1st SATURDAY

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**4 . Timetable**

	1	2	3	4		5	6
	08:50 AM 09:50 AM	08:50 AM 04:45 PM	09:50 AM 10:50 AM	11:05 AM 12:05 PM	12:05 PM 01:45 PM	01:45 PM 04:45 PM	02:45 PM 03:45 PM
MON	BE 18CV825 CV Semester 8 A	BE 21CV42 CV Semester 4 A		BE 21CV42 CV Semester 4 A		BE 21CV42 CV Semester 4 A	
TUE	BE 18CV825 / 18CV63 CV Semester 8 / Semester 6 A		BE 21CV42 CV Semester 4 A				
WED	BE 18CV825 CV Semester 8 A		BE 21CV42 CV Semester 4 A	BE 18CV63 CV Semester 6 A		BE 21CVL46 CV Semester 4 A	
THU		BE 18CV63 CV Semester 6 A					BE 18CVP83 CV Semester 8 A
FRI			BE 21CV42 CV Semester 4 A			BE 18CVP83 CV Semester 8 A	
SAT		BE 18CV63 CV Semester 6 A				BE 18CVP83 CV Semester 8 A	



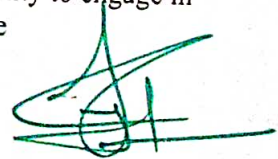
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## 5 . Department Details

### 5 . 1 Preliminary Information

#### PROGRAM OUTCOMES(PO's)

1. **Engineering knowledge** : Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis** : Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences
3. **Design/Development of Solutions** : Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations
4. **Conduct investigations of complex problems** : Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions
5. **Modern tool usage** : Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations
6. **The engineer and society** : Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice
7. **Environment and sustainability** : Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development
8. **Ethics** : Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice
9. **Individual and team work** : Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings
10. **Communication** : Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions
11. **Project management and finance** : Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments
12. **Life-long learning** : Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change



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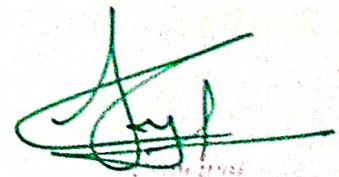
### PROGRAM SPECIFIC OUTCOMES(PSO's)

**PSO 1 :** Will be trained to excel in their professional career by factual, analytical, procedural, application and creative knowledge in mathematical computing and Civil Engineering Principles

**PSO 2 :** Will be trained to analyse and design sustainable Civil engineering systems which involve sound Civil Engineering skills optimum and acceptable solution to the society

**PSO 3 :** Will be trained to exhibit professionalism, ethics and with the good communication skills background

**PSO 4 :** Will be trained in continuing education and engage them in lifelong learning to the competitive and enterprising



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**6 . Course Information**
**6 . 1 Course Content**
**Title of the Course : PAVEMENT DESIGN**
**Semester : 8**
**Academic Year : 2022-23**

Subject Code : 18CV825	IA Marks : 40
Hours/week : 3	Total Hours : 40
Exam Hours : 3	Exam Marks : 60
Course Plan Author : Prasad Gaonkar	Planned Date : 2023-02-13
Approved by : Mr Prashanth Hegde	Approved Date : 2023-02-13
<b>Objectives:</b> 1 . Gain knowledge about the process of collecting data required for design, factors affecting pavement design, and maintenance of pavement 2 . Excel in the path of analysis of stress, strain and deflection in pavement 3 . Understand design concepts of flexible pavement by various methods (CBR, IRC 37-2001, Mcleods, Kansas ) and also the same of rigid pavement by IRC 58-2002 4 . Understand the various causes leading to failure of pavement and remedies for the same 5 . Develop skills to perform functional and structural evaluation of pavement by suitable methods	
<b>Course Outcomes (COs) :</b> 1 . Systematically generate and compile required data for design of pavement (Highway & Airfield) 2 . Analyze stress, strain and deflection by boussinesq's, bur mister's and westergaard's theory 3 . Design rigid pavement and flexible pavement conforming to IRC58-2002 and IRC37-2001 4 . Evaluate the performance of the pavement and also develops maintenance statement based on site specific requirements	



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**6 . Course Information****6 . 1 . 1 Course Syllabus****Objectives:****Title of the Course : PAVEMENT DESIGN****Subject Code : 18CV825****Module 1****Introduction :**

Desirable characteristics of pavement, Types and components, Difference between Highway pavement and Air field pavement, Design strategies of variables, Functions of sub grade, sub base, Base course, surface course, comparison between Rigid and flexible pavement Fundamentals of Design of Pavements: Stresses and deflections, Principle, Assumptions and Limitations of Boussinesq's theory, Burmister theory and problems on above

**Module 2****Design Factors :**

Design wheel load, contact pressure, Design life, Traffic factors, climatic factors, Road geometry, Subgrade strength and drainage, ESWL concept Determination of ESWL by equivalent deflection criteria, Stress criteria, EWL concept, and problems on above, Flexible pavement Design: Assumptions, McLeod Method, Kansas method, CBR method, IRC Method (old), CSA method using IRC, 37, 2001, problems on above

**Module 3****Flexible Pavement Failures, Maintenance and Evaluation :**

Types of failures, Causes, Remedial/Maintenance measures in flexible pavements, Functional Evaluation by Visual inspection and unevenness measurements, Structural evaluation by Benkleman beam deflection method, Falling weight deflecto meter, GPR method, Design factors for runway pavements, Design methods for Airfield pavement and problems on above

**Module 4****Stresses in Rigid Pavement :**

ypes of stress, Analysis of Stresses, Westergaard's Analysis, Modified Westergaard equations, Critical stresses, Wheel load stresses, Warping stress, Frictional stress, combined stresses (using chart / equations), problems on above

**Design of Rigid Pavement :**

Design of CC pavement by IRC: 58, 2002 for dual and Tandem axle load, Reinforcement in slabs, Design of Dowel bars, Design of Tie bars, Design factors for Runway pavements, Design methods for airfield pavements, problems of the above

**Module 5****Rigid Pavement Failures, Maintenance and Evaluation :**

Types of failures, causes, remedial/maintenance measures in rigid pavements, Functional evaluation by Visual inspection and unevenness measurements, wheel load and its repetition, properties of sub grade, properties of concrete, External conditions, joints, Reinforcement, Requirements of joints, Types of joints, Expansion joint, contraction joint, warping joint, construction joint, longitudinal joint, Design of joints

**6 . Course Information**

**6 . 1 . 2 Text Books and Reference Books**

**TEXT BOOKS :**

- 1 . S K Khanna, C E G Justo, and A Veeraragavan, "Highway Engineering", Nem Chand & Brothers
- 2 . L.R.Kadiyali and Dr.N.B.Lal, " Principles and Practices of Highway Engineering", Khanna publishers
- 3 . Yang H. Huang , "Pavement Analysis and Design", University of Kentucky

**REFERENCE BOOKS :**

- 1 . Yoder & wit zorac, "Principles of pavement design", John Wiley & Sons
- 2 . SubhaRao, "Principles of Pavement Design"
- 3 . R Srinivasa Kumar, "Pavement Design", University Press
- 4 . Relevant recent IRC codes



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**6. Course Information**
**6.2**
**Semester : 8**
**Section : A**
**Course : PAVEMENT DESIGN**

Period	Plan/Execution	Date	Topic	Source material to be referred	Course Outcome	Bloom's Level	Execution Methods	Learning Validation Method
<b>Module 1</b>								
1	P	13 Feb 2023	Desirable characteristics of pavement, Types and components				Lecture	
1	E	13 Feb 2023	Desirable characteristics of pavement, Types and components	-	CO 1	Understand	Lecture	
2	P	14 Feb 2023	Difference between Highway pavement and Air field pavement, Design strategies of variables				Lecture	
2	E	14 Feb 2023	Difference between Highway pavement and Air field pavement, Design strategies of variables	Text 1	CO 1	Understand	Lecture	
3	P	15 Feb 2023	Functions of sub grade, sub base				Lecture	
3	E	15 Feb 2023	Functions of sub grade, sub base	Text 1	CO 1	Understand	Lecture	
4	P	20 Feb 2023	Base course, surface course				Lecture	
4	E	20 Feb 2023	Base course, surface course	Text 1	CO 1	Understand	Lecture	
5	P	21 Feb 2023	comparison between Rigid and flexible pavement Fundamentals of Design of Pavements: Stresses and deflections				Lecture	
5	E	21 Feb 2023	comparison between Rigid and flexible pavement Fundamentals of Design of Pavements: Stresses and deflections	-	CO 1	Understand	Lecture	
6	P	22 Feb 2023	Principle				Lecture	
6	E	22 Feb 2023	Principle	-	CO 1	Understand	Lecture	
7	P	27 Feb 2023	Assumptions and Limitations of Boussinesq's theory				Lecture	
7	E	27 Feb 2023	Assumptions and Limitations of Boussinesq's theory	Text 1	CO 1	Understand	Lecture	
8	P	28 Feb 2023	Burmister theory and problems on above				Lecture	
8	E	28 Feb 2023	Burmister theory and problems on above	Text 1	CO 1	Evaluate	Lecture	
<b>Module 2</b>								
9	P	1 Mar 2023	Design wheel load, contact pressure, Design life				Lecture	



Period	Plan/Execution	Date	Topic	Source material to be referred	Course Outcome	Bloom's Level	Execution Methods	Learning Validation Method
9	E	1 Mar 2023	Design wheel load, contact pressure, Design life	Text 1	CO 2	Apply	Lecture	
10	P	6 Mar 2023	Traffic factors, climatic factors, Road geometry				Lecture	
10	E	6 Mar 2023	Traffic factors, climatic factors, Road geometry	Text 1	CO 2	Understand	Lecture	
11	P	7 Mar 2023	Subgrade strength and drainage, ESWL concept Determination of ESWL by equivalent deflection criteria, Stress criteria				Lecture	
11	E	7 Mar 2023	Subgrade strength and drainage, ESWL concept Determination of ESWL by equivalent deflection criteria, Stress criteria	Text 1	CO 2	Understand	Lecture	
12	P	8 Mar 2023	EWL concept, and problems on above, Flexible pavement Design: Assumptions				Lecture	
12	E	8 Mar 2023	EWL concept, and problems on above, Flexible pavement Design: Assumptions	-	CO 2	Understand	Lecture	
13	P	13 Mar 2023	McLeod Method, Kansas method				Lecture	
13	E	13 Mar 2023	McLeod Method, Kansas method	-	CO 2	Understand	Lecture	
14	P	14 Mar 2023	CBR method, IRC Method (old)				Lecture	
14	E	14 Mar 2023	CBR method, IRC Method (old)	-	CO 2	Apply	Lecture	
15	P	15 Mar 2023	CSA method using IRC,37				Lecture	
15	E	15 Mar 2023	CSA method using IRC, 37	Text 2	CO 2	Apply	Lecture	
16	P	20 Mar 2023	2001, problems on above				Lecture	
16	E	20 Mar 2023	2001, problems on above	-	CO 2	Evaluate	Lecture	
<b>Module 3</b>								
17	P	21 Mar 2023	Types of failures, Causes				Lecture	
17	E	21 Mar 2023	Types of failures, Causes	Text 1	CO 2	Understand	Lecture	
18	P	27 Mar 2023	Remedial/Maintenance measures in flexible pavements				Lecture	
18	E	27 Mar 2023	Remedial/Maintenance measures in flexible pavements	Text 1	CO 3	Remember	Lecture	
19	P	28 Mar 2023	Functional Evaluation by Visual inspection and unevenness measurements				Lecture	



Period	Plan/Execution	Date	Topic	Source material to be referred	Course Outcome	Bloom's Level	Execution Methods	Learning Validation Method
19	E	28 Mar 2023	Functional Evaluation by Visual inspection and unevenness measurements	-	CO 3	Understand	Lecture	
20	P	29 Mar 2023	Structural evaluation by Benkleman beam deflection method				Lecture	
20	E	29 Mar 2023	Structural evaluation by Benkleman beam deflection method	-	CO 3	Understand	Lecture	
21	P	4 Apr 2023	Falling weight deflecto meter				Lecture	
21	E	4 Apr 2023	Falling weight deflecto meter	-	CO 3	Understand	Lecture	
22	P	5 Apr 2023	GPR method				Lecture	
22	E	5 Apr 2023	GPR method	-	CO 3	Apply	Lecture	
23	P	10 Apr 2023	Design factors for runway pavements				Lecture	
23	E	10 Apr 2023	Design factors for runway pavements	Text 1	CO 3	Understand	Lecture	
24	P	11 Apr 2023	Design methods for Airfield pavement and problems on above				Lecture	
24	E	11 Apr 2023	Design methods for Airfield pavement and problems on above	-	CO 3	Apply	Lecture	
<b>Module 4</b>								
25	P	12 Apr 2023	types of stress, Analysis of Stresses, Westergaard's Analysis				Lecture	
25	E	12 Apr 2023	types of stress, Analysis of Stresses, Westergaard's Analysis	-	CO 3	Analyze	Lecture	
26	P	17 Apr 2023	Modified Westergaard equations, Critical stresses, Wheel load stresses				Lecture	
26	E	17 Apr 2023	Modified Westergaard equations, Critical stresses, Wheel load stresses	Text 1	CO 3	Understand	Lecture	
27	P	18 Apr 2023	Warping stress, Frictional stress				Lecture	
27	E	18 Apr 2023	Warping stress, Frictional stress	Text 1	CO 3	Understand	Lecture	
28	P	19 Apr 2023	combined stresses (using chart / equations), problems on above				Lecture	
28	E	19 Apr 2023	combined stresses (using chart / equations), problems on above	-	CO 3	Evaluate	Lecture	
29	P	24 Apr 2023	Design of CC pavement by IRC: 58,2002 for dual and Tandem axle load				Lecture	
29	E	24 Apr 2023	Design of CC pavement by IRC: 58, 2002 for dual and Tandem axle load	Text 1	CO 3	Understand	Lecture	



Period	Plan/Execution	Date	Topic	Source material to be referred	Course Outcome	Bloom's Level	Execution Methods	Learning Validation Method
30	P	25 Apr 2023	Reinforcement in slabs, Design of Dowel bars				Lecture	
30	E	25 Apr 2023	Reinforcement in slabs, Design of Dowel bars	-	CO 4	Apply	Lecture	
31	P	26 Apr 2023	Design of Tie bars, Design factors for Runway pavements				Lecture	
31	E	26 Apr 2023	Design of Tie bars, Design factors for Runway pavements	-	CO 4	Analyze	Lecture	
32	P	2 May 2023	Design methods for airfield pavements, problems of the above				Lecture	
32	E	2 May 2023	Design methods for airfield pavements, problems of the above	-	CO 4	Understand	Lecture	
<b>Module 5</b>								
33	P	3 May 2023	Types of failures, causes, remedial/maintenance measures in rigid pavements				Lecture	
33	E	3 May 2023	Types of failures, causes, remedial/maintenance measures in rigid pavements	-	CO 4, CO 1	Understand	Lecture	
34	P	8 May 2023	Functional evaluation by Visual inspection and unevenness measurements, wheel load and its repetition, properties of sub grade				Lecture	
34	E	8 May 2023	Functional evaluation by Visual inspection and unevenness measurements, wheel load and its repetition, properties of sub grade	-	CO 4, CO 1	Apply	Lecture	
35	P	9 May 2023	properties of concrete, External conditions				Lecture	
35	E	9 May 2023	properties of concrete, External conditions	-	CO 3, CO 2	Analyze	Lecture	
36	P	10 May 2023	joints, Reinforcement				Lecture	
36	E	10 May 2023	joints, Reinforcement	-	CO 3, CO 2	Apply	Lecture	
37	P	15 May 2023	Requirements of joints, Types of joints				Lecture	
37	E	12 May 2023	Requirements of joints, Types of joints	-	CO 2, CO 3	Apply	Lecture	
38	P	16 May 2023	Expansion joint, contraction joint				Lecture	
38	E	11 May 2023	Expansion joint, contraction joint	-	CO 4, CO 1	Analyze	Lecture	
39	P	17 May 2023	warping joint, construction joint				Lecture	



Period	Plan/Execution	Date	Topic	Source material to be referred	Course Outcome	Bloom's Level	Execution Methods	Learning Validation Method
39	E	9 May 2023	warping joint, construction joint	-	CO 4, CO 1	Analyze	Lecture	
40	P	22 May 2023	longitudinal joint, Design of joints				Lecture	
40	E	5 May 2023	longitudinal joint, Design of joints	-	CO 4, CO 1	Analyze	Lecture	



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**6 . Course Information**
**6 . 2 . 1 Compliance Report**

Semester : 8

Section : A

Course : PAVEMENT DESIGN

Module No.	# of Classes Planned(till date)	Planned Effort(till date)	# of Classes Executed(till date)	Actual Efforts(till date)	% Coverage
1	8	8hrs 0min	8	8hrs 0min	100.0
2	8	8hrs 0min	8	8hrs 0min	100.0
3	8	8hrs 0min	8	8hrs 0min	100.0
4	8	8hrs 0min	8	8hrs 0min	100.0
5	8	8hrs 0min	8	8hrs 0min	100.0



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6. Course Information

6.2.2 CO PO Mapping

Slight (Low) = 1 ,

Moderate (Medium) = 2 ,

Substantial (High) = 3 .

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	3	2	3	3	2				1		3
CO 2	3	2	3	1	2	2				1		1
CO 3	2	3	3	2	2	3				1		1
CO 4	3	3	2	2	3	2						2



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6. Course Information

6.2.3 CO-PSO Mapping

Slight (Low) = 1 ,

Moderate (Medium) = 2 ,

Substantial (High) = 3 .

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4
CO 1	2	3	2	3
CO 2	3	2	3	2
CO 3	2	3	2	2
CO 4	3	2	3	3

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