ผลกระทบของน้ำท่วมต่อคุณสมบัติทางพลศาสตร์ของโครงสร้างทางรถไฟแบบมีหินโรยทาง

The Effects of Flooding Conditions on Dynamic Behaviour of Ballasted Railway Tracks

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บทคัดย่อ

(Ballasted Track)

(Fundamental Mode Shape) (Natural Frequency)

(25%)

2

3

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,

,

,

Abstract

Ballasted track is the most used track structure in Thailand, which are expanded nationwide due to their ease and speed of construction which make them a cost-effective solution for the railway industry. However, with global warming causing more volatile weather conditions and heavy rain, which leads to multiple occurrences of flooding in Thai railway structures. Therefore, the impact of flooding on the dynamic behaviour of the ballasted track structure should be investigated. Although the impact of flooding on the dynamic behavior of ballasted-track structure has been extensively studied, the effect of washed away conditions on sleeper mode shape and natural frequencies has not been thoroughly explored. This study found that the sensitivity of natural frequencies under loss of supporting layer varies for each fundamental mode, with lower modes being more sensitive. The natural frequency initially increases at 25% loss of support but then reduces to a similar value at a fully washed away condition prior to support loss. The first and second mode shapes are not significantly affected by the loss of support. However, for the third mode shape, if the supporting layer is asymmetrical, the mode shape will change due to the unevenness of the ballast layer.

Keywords: Ballasted track, Flooding, Natural frequency, fundamental mode shape, Dynamic Models

1. คำนำ

(Ballasted tracks) (Ballastless tracks)

,

,

(Fastening systems),

(Washed away condition)

1



รูปที่ 1

. . 2559 [1]

(Track Twisting)
(Misalignment)
(Track Buckling)

[2]

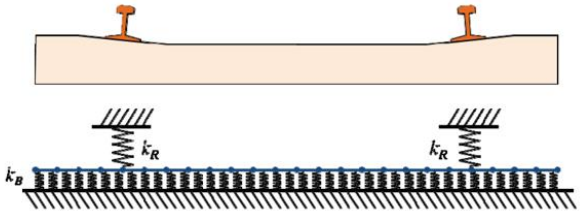
[3]

[4]

(Fundamental Mode Shape) (Natural Frequency)

2. แบบจำลองปฏิสัมพันธ์ของไม้หมอนบนหินโรยทาง

Lam Wong [2] 2

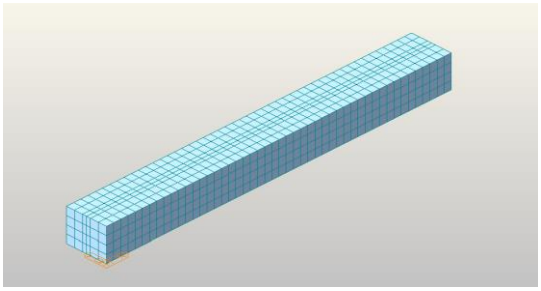


รูปที่ 2 [2]

k_R k_B

Lam Wong [2]

(3D solid elements)
MIDAS Civil 3



รูปที่ 3 MIDAS Civil

MIDAS Civil

(1)

$$\left(\mathbf{K}-\omega_i^2\mathbf{M}\right)\phi_i=\mathbf{0} \quad (1)$$

MIDAS Civil

Lanczos

,

Lam Wong

[2] 1

ตารางที่ 1 [2]

พารามิเตอร์ [หน่วย]	ค่าที่ใช้
- , L [m]	2.420
- , L_R [m]	0.403
- , h [m]	0.210
- , b [m]	0.280
- Young, E [N/m^2]	4.0 x 10^{10}
- , ρ [N/m^3]	2750
- , k_R [N/m^3]	2.059 x 10^{11}
- , k_B [N/m^3]	2.8 x 10^8

3. ผลกระทบของการพัดพาชั้นหินโรยทาง

,

[5]

(Liquefaction)

4a

4b

3 5

[4]

รูปที่ 4 (a) (b) [4]

รูปที่ 5 (a) , (b) , (c)

5 , 75%, 50%, 25%

6a, 6b, 6c, 6d 6e 100%

2

ตารางที่ 2

รูปที่ 9 3 (790.43 Hz)

[2]

MIDAS Civil

3

3

รูปที่ 6

(a) , (b) 75% 10

(c) 50%, (d) 25%

(e)

ตารางที่ 3

4. ผลการศึกษา

3 7, 8 9

รูปที่ 7 1 (236.10 Hz)

รูปที่ 8 2 (599.31Hz)

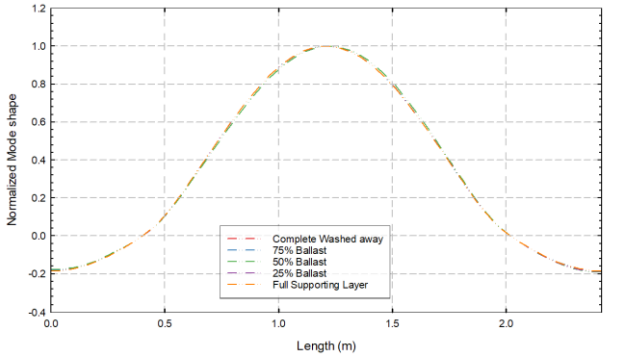
11

1 2 11a 11b 3

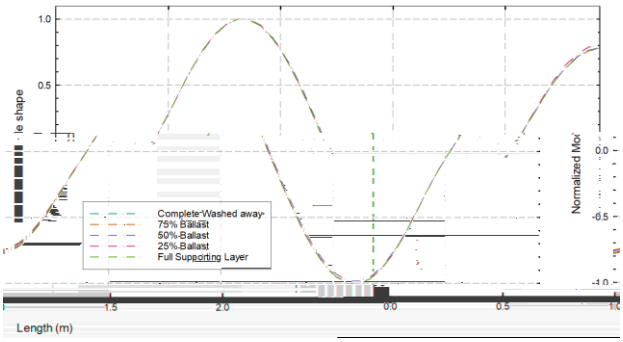
MIDAS Civil

0

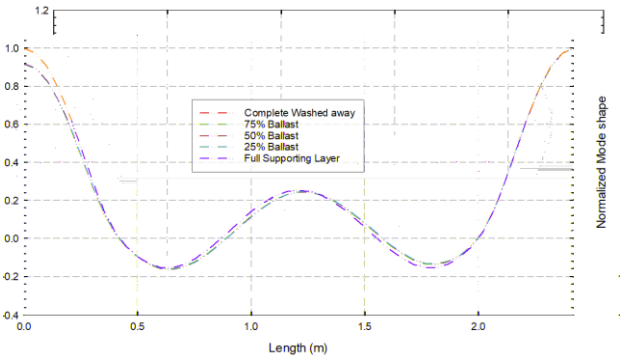
(25%, 50%, 75%)



(a)



(b)



(c)

รูปที่ 11
(a) 1, (b) 2, (c) 3

5. บทสรุป

2

3

กิตติกรรมประกาศ

100

เอกสารอ้างอิง

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