**[Organizing vehicle transportation and traffic safety] week11 - Work calculation of one-way shuttle pendulum route.**

**MAVZU-11: Bir tomonlama mayatnik marshrutining ish hisobi.**

**Reja:**

11.1. Mayatnik marshrutlar turlari.

11.2. Bir tomonlama yukli qatnovchi mayatnik marshrutda transport vositalari ish hisobi.

11.3. Ikki tomonlama yukli qatnovchi mayatnikli marshrutda transport vositalari ish hisobi.

**Tayanch so‘z va iboralar:** *nolinchi qatnov, yuk hajmi, ikki tomonlama yukli qatnovchi mayatnikli marshrut, teskari yo‘nalish, harakat tezligi, avtomobilning ish vaqti, yuk ortish vaqti, yo‘ldan foydalanish koeffitsiyenti, avtomobillar saroyi, shaxarlararo tashish, xalqaro tashish.*

## 11.1. Mayatnik marshrutlar turlari

**Mayatniksimon marshruti -** bu ikki nuqta orasidagi harakat ko‘p marta takrorlanadigan marshrut. Mayatniksimon marshrutlari uch xil: teskari bo‘shashmasdan; teskari to‘liq yuklanmagan kilometr bilan; ikki tomonga ham yuklangan masofa bilan**.**

**1-jadval**

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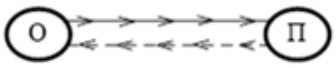
| Bir tomonlama mayatniksimon marshruti |   |
| Ikki tomonlama mayatniksimon marshruti |   |

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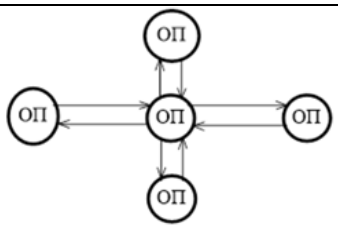
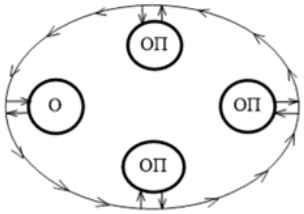
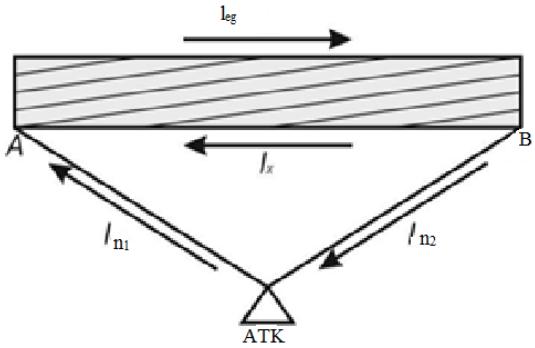
|---|---|
| Nursimon-mayatnik marshruti |   |
| Xalqasimon marshruti |   |

Orqaga bo‘sh harakat bilan qaytish oddiy mayatniksimon marshrut deb ataladi (1-rasm).

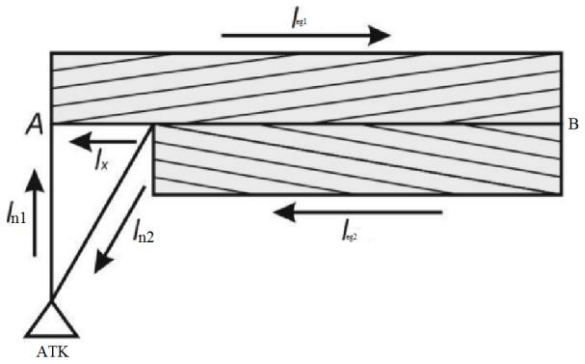



**1-rasm. Orqaga bo‘sh harakat bilan mayatniksimon marshrut diagrammasi**.

Oddiy mayatnikli marshrutda ishlaganda mashina A nuqtada yuklanadi va yukni B nuqtaga masofadan $l_{eg}$ masalan. B nuqtasida mashina yukni tushiradi va 1-sonli bo‘sh harakatni A nuqtasiga qaytaradi. Bunday marshrut maqsadga muvofiq emas, chunki u ustida ishlaganda bitta aylanada yuk bilan bitta sayohat amalga oshiriladi. Qatnashlardan foydalanish koeffitsienti oddiy mayatniksimon marshrutida 0,5 ga teng, chunki $l_{eg} = l_X$.

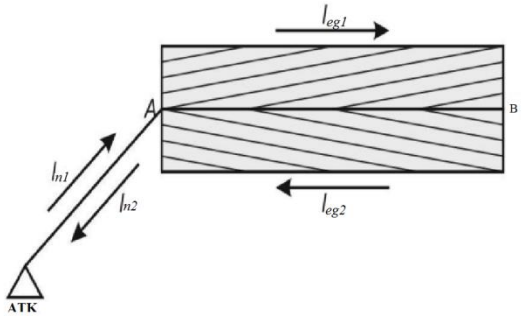
Qaytib to‘liq yuklanmagan yurish bilan mayatniksimon marshruti bo‘ylab transport vositalarining harakatini tashkil qilishda, yo‘lning bir yo‘nalishida (qoida tariqasida, teskari yo‘nalishda) bir qismi transport vositasi yuk bilan, bir qismi esa yuksiz harakatlanadi. Shu munosabat bilan ushbu yo‘nalish turli xil sxemalarga ega bo‘lishi mumkin.

Bunday marshrutda ishlaganda bitta aylanishda ikkita sayohat qilinadi. Ushbu yo‘nalishda harakatlanuvchi tarkibning yurish masofasidan foydalanish 50% dan ortiq, ammo 100% dan kam, ya'ni. $0,5 < s < 1$.



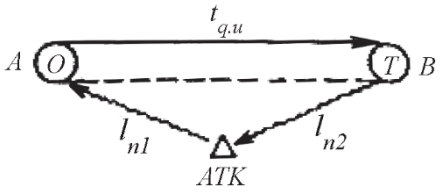

**3-rasm. Orqaga to‘liq yuklanmagan mayatniksimon marshrutining sxemasi**

Orqaga yuklangan marshruti harakatlanuvchi tarkibning to‘liq ishlatilishini ta'minlaydi: yuk marshrutda ham A nuqtadan B nuqtaga va orqaga, ya'ni A va B nuqtalar bu holatda ham yuklash joylari, ham tushirish punktlari hisoblanadi. Oldinga va teskari yo‘nalishdagi masofa bir xil, bu harakatlanuvchi tarkibning yurish masofasidan to‘liq foydalanishni ta'minlaydi, ya'ni. $s = 1$. Bitta aylanishda ikkita sayohat amalga oshiriladi.




**4-rasm. Ikkala yo‘nalishda ham yuklangan harakatlanuvchi mayatniksimon marshrutining sxemasi**

## 11.2 Bir tomonlama yukli qatnovchi mayatnik marshrutda transport vositalari ish hisobi




**6 - rasm.**

**Yuk tashish tasviri**

Berilgan:

$l_{n1}$ = 4 km, $l_{n2}$ = 8 km, $l_{qu}$ = 10km

$Q_{reja}$ = 30000 t, tashish muddati $K_t$ = 30 kun, yuklar ISUZU avtomobilida tashiladi, $v_t$ = 20km/soat, $t_{o\text{-}t}$ = 0.8 soat, $\gamma_s$ = 1,0, $T_i$ = 14 soat, $\beta_q$ = 0,5 soat

Yechish:

1. Qatnov vaqtini aniqlaymiz:

$$T_q = \frac{l_{qu}}{b_q u_t} + t_{o-t} = \frac{l_y}{b u_t} + t_{o-t} = \frac{10}{0.5*20} + 0.3 = 1.8$$

Bunda: $l_{qu} = l_{yu}$

2. Yo‘nalish vaqtini aniqlaymiz.

$$T_y = T_i - \frac{l_{n1}+l_{n2}}{u_t} = 14 - \frac{4+8}{20} - 14 - 0{,}6 - 13{,}4$$

3. Bir ish kunidagi qatnovlar sonini aniqlaymiz.

$$n_q = \frac{T_y b\, u_t}{l_y + b\, u_t t_{o\text{-}t}} = \frac{T_y}{t_q} = \frac{13{,}4}{1{,}8} = 7{,}44$$

Bu sonni yaxlitlaymiz. $n_q \approx 7$

4. Avtomobilning yo‘nalishdagi va ish vaqtidagi qatnovlar sonini yaxlitlash orqali qaytadan aniqlaymiz:

$$T_i^{`} = t_q * n_q^{`} = 1{,}8 * 7 = 12{,}6$$

$$T_i^{`} = T_y^{`} + \frac{l_{n1} + l_{n2}}{u_t} - 12{,}6 + \frac{4+8}{20} - \frac{10}{20} = 12{,}7$$

5. Bir kunlik tashilgan yuk hajmi va yuk aylanishini aniqlaymiz:

$$Q_k = q_n \gamma_s n^{`}_q = 4 * 1 * 7 = 28\ t$$

$$P_k = q_n \gamma_d \, l_{qu} n`_q = Q_k l_{qu} = 28 * 10 = 280 \, t * km$$

6. Tashish rejasini bajarish uchun zarur avtomobillar sonini aniqlaymiz.

$$A_c = \frac{Q_{reja}}{K_t \, Q_k} = \frac{30000}{30 * 28} = 36 \text{ avtomobil}$$

7. Avtomobilning sutkada yurish masofasini aniqlaymiz:

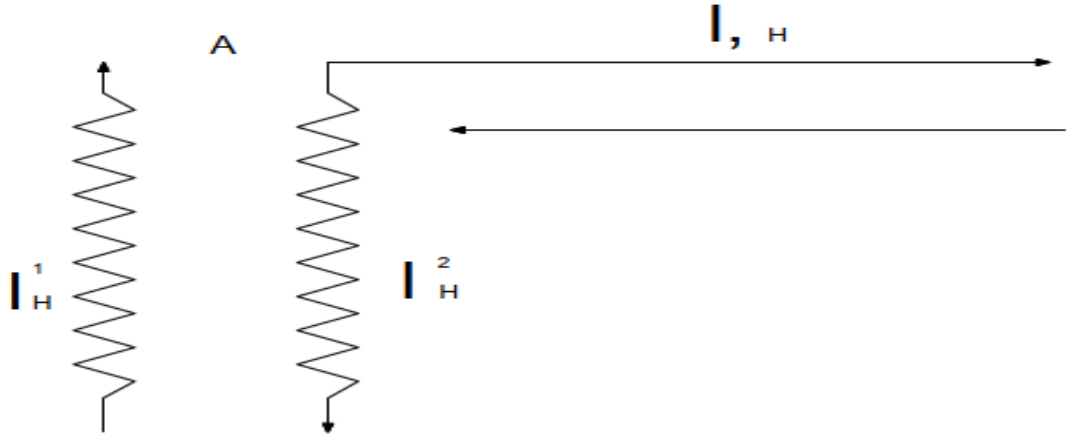
$$l_y = \frac{n_q * l_{qu}}{b_q} - l_b + (l_{n1} + l_{n2}) = \frac{7*10}{0{,}5} - 10 + (4 + 8) = 142 \, km$$

8. Ish kunida avtomobilning masofadan foydalanish koeffitsientini aniqlaymiz.

$$b = \frac{l_{yu}}{l_u} = \frac{n_q * l_{qu}}{l_u} = \frac{7 * 10}{142} = 0{,}49$$

### 11.3. Ikki tomonlama yukli qatnovchi mayatnikli marshrutda transport vositalari ish hisobi

Orqa yo‘nalishda ham yuk bilan qatnaydigan mayatnikli marshrut (8-rasm) dagi yuk tashuvchi transport vositalari ishini hisoblashda quyidagi birlamchi ko‘rsatkichlarni olamiz: $l_{yuq}$=10km, nolinchi qatnovlar $l_o^1 = l_o^{11}$=4km, transport vositasining ishda bo‘lish vaqti $T_{ish}$ = 16 soat, A nuqta (joy)dan B nuqtagacha tashiluvchi yuklar hajmi $Q_{AB}$=20000t. B nuqtadan A nuqtagacha (orqaga) tashiluvchi yuklar hajmi $Q_{BA}$=20000t. ikkala tomonga ham tashiluvchi yuklar 1-sinfga mansub, ya`ni $\gamma_{st}$ =1.0 ga teng. tashish muddati 20 kun. Ishlovchi avtomobil ISUZU ($q_n$=4t). Harakat tezligi $V_T$ =25km/soat, har bir yukli qatnovda ortish-tushirishda turish vaqti $t_{o-t}$ =0.6soat.




**7-rasm. Orqa yo‘nalishda ham yuk bilan qatnaydigan mayatnikli marshrut**

Hisoblash tartibi:

1.Marshrut ichi yo‘ldan foydalanish koeffitsiyenti $\beta_m$ =1,0 ekanligini nazarda tutib, avtomobilning marshrutda ishlash vaqtini aniqlaymiz:

$$T_M=T_{ish}-t_o=T_{ish}-\frac{l_o^1+l_o^{11}}{V_T}=16-\frac{4+4}{25}=15.68$$

2.Avtomobilning bir kundagi yukli qatnovlarini hisoblaymiz:

$$Z_{yuq}=\frac{T_M\beta_M V_T}{l_{yuq}+\beta_M V_T t_{o-t}}=\frac{15.68\cdot1.0\cdot25}{10+1.0\cdot25\cdot0.6}=15.68$$

Qatnovlar sonini yaxlitlab (16 ga keltirib), marshrutdagi vaqtni qayta hisoblaymiz:

$$T_M^1=\frac{Z_{yuq}^1\,(l_{yuq}+\beta_M V_T t_{o-t})}{\beta_M V_T}=\frac{16(10+1.0\cdot25\cdot0.6)}{1.0\cdot25}=16 \text{ soat}$$

Ish vaqti esa:

$$T_{ish}^1=T_M^1+t_o=16+0.32=16.32 \text{ soat bo‘ladi}$$

3.Avtomobilning bir kunlik ish unumi:

tonnada

$$Q_K=q_n\,\gamma_{st}\,Z_{yuq}=4*1.0*16=64 \text{ t}$$

tonna kilometrda:

$$P_K=q_n\,\gamma\,Z_{yuq}\,l_{yuq}=4.0*1.0*16*10=640\text{tkm}$$

Tashish rejasini bajarish uchun zarur avtomobillar soni:

$$A_E=\frac{Q_{AB}+Q_{BA}}{K_{ish}Q_K}=\frac{20000+20000}{2*64}=31$$

4. Avtomobilning kunlik qatnov masofasi:

$$L_{sut} = Z^1_{yuq}\ l_{yuq} + (l^1_o + l^{11}_o) = 16*10+(4+4) = 168 \text{ km}$$

Kun davomida avtomobilning yo‘ldan foydalanish koeffisienti:

$$\beta = \frac{Z^1_{yuq}\, l_{yuq}}{L_{sut}} = \frac{10*16}{168} = 0.95$$

Agar ikkala yo‘nalishdagi yukli qatnovlarda ham har xil sinfga mansub yuklar tashilsa, ya’ni yuk ko‘taruvchanliklardan foydalanish koeffitsiyentlari birlamchi va orqa yo‘nalishda o‘zaro teng bo‘lmaganda transport vositasining tonnada o‘lchanuvchi ish unumi quyidagicha aniqlanadi:

$$Q_K = (q_n \gamma_{AB} + q_n \gamma_{BA}) = \frac{Z^1_{yuq}}{2}, \quad (53)$$

bunda $q_n$ ni qavsdan chiqarsak,

$$Q_K = q_n (\gamma_{AB} + \gamma_{BA}) = \frac{Z^1_{yuq}}{2}, \quad (54)$$

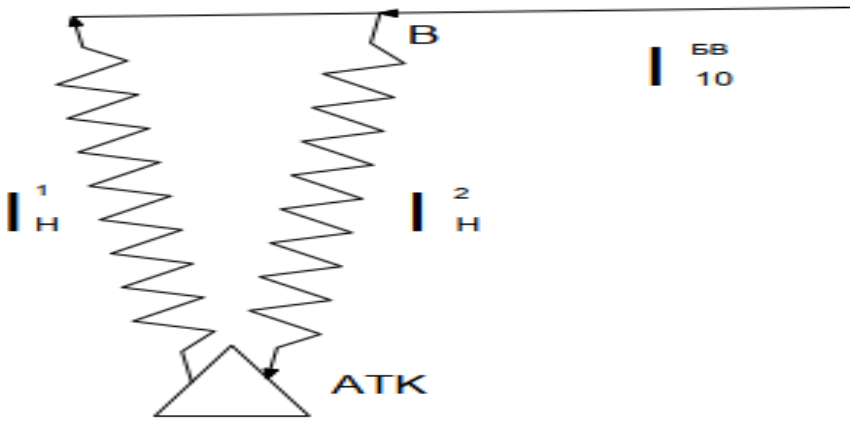
Ayni shartga ko‘ra transport vositasining tonna-kilometrdagi ish unumi quyidagicha:

$$P_K = (q_n \gamma_{AB}\, l_{yuq} + q_n \gamma_{BA}\, l_{yuq}) = \frac{Z^1_{yuq}}{2} * l_{yuq} \quad (55)$$

yoki $P_K = Q_K\, l_{yuq}$ bo‘ladi. Qolgan hisoblarda o‘zgarishlar bo‘lmaydi.

## Orqa yo‘nalishda qisman yukli mayatnik marshrutda transport vositalari ish hisobi

Mazkur mayatnikli marshrutda yuk tashuvchi transport vositalarini hisoblashda quyidagi birlamchi ko‘rsatkichlardan foydalanamiz.




**8-rasm. Orqaga to‘liq bo‘lmagan yukli mayatnikli qatnov**

Avtomobilning ishda bo‘lish vaqti $T_{ish}$=12 soat AB birlamchi (to‘g‘ri) yo‘nalishda tashiluvchi yuklar hajmi 200 000 t, birinchi sinfli yuk ($\gamma$=1,0 ), marshrutning teskari yo‘nalishdagi BV bo‘lagida tashiluvchi yuklar hajmi 180 000 t bo‘lib, yuk ko‘taruvchanlikdan foydalanish koeffitsiyenti $\beta_{BV}$=0,9. Tashiluvchi yuklar uyulib tashiluvchi va sochiluvchan bo‘lganligi uchun ularni yuk ko‘taruvchanligi 4,5t li samosval avtomobillarda tashish mo‘ljallangan. Yukni ortish uchun zarur vaqt $t_o$ = 0,15 soat, tushirish vaqti $t_T$= 0,1 soat. Tashish muddati 120 kun. Avtomobilning harakat tezligi $V_T$ = 24 km/soat.

Hisoblash tartibi:

1 . Avtomobilning marshrutda ishlash vaqtini topamiz:

$$T_M = T_{ish} - \frac{l_o^1 + l_o^{11}}{V_T} = 12 - \frac{5+5}{24} = 11.58$$

avtomobilning marshrutdagi bir aylanish vaqtini aniqlaymiz:

$$t_{ayl} = \sum t_x + \sum_{to\text{-}t} = t_o^A + t_h^{AB} + t_t^B + t_o^B + t_h^{BV} + t_t^V + t_h^{VA} ;$$

$$t_{ayl} = t_o^A + \frac{l_{yuq}^{AB}}{V_T} + t_t^B + t_o^B + \frac{l_{yuq}^{BV}}{V_T} + t_t^V + t_{bq}^{VA} = 0.15 + \frac{12}{24} + 0.1 + .015 + \frac{8}{24} + 0.1 + \frac{4}{24} =$$

1.5 soat

2. Avtomobilning marshrutdagi bir kunlik aylanishlar soni:

$$Z_{ayl} = \frac{T_M}{t_{ayl}} = \frac{11.58}{1.5} = 7.7$$

Aylanishlar sonini yaxlit 8 ga keltirib, vaqtlarni qayta hisoblaymiz:

marshrutdagisi

$$T_M^1 = Z_{ayl}^1 \qquad t_{ayl} = 8 \qquad 1.5 = 12 \text{ soat}$$

Ishdagisi

$$T_{ish}^1 = T_M^1 + t_o = 12 + 0.42 = 12.42 \text{ soat}$$

3. Avtomobilning bir kunlik ish unumini hisoblaymiz:

tonnada

$$Q_K = (q_n \gamma_{AB} + q_n \gamma_{BV}) \qquad Z^1{}_{ayl} = q_n (\gamma_{AB} + \gamma_{BV}) = 4.5 (1.0+0.9)\ 8 = 64.6 \text{ t}$$

tonna – kilometrda

$$P_K = (q_n \gamma_{AB}\, l_{yuq}^{AB} + q_n \gamma_{BV}\, l_{yuq}^{BV}) \qquad Z^1{}_{ayl} \text{ tkm}$$

yoki

$P_K = (q_n \gamma_{AB} l_{yuq}^{AB} + q_n \gamma_{BV} l_{yuq}^{BV})$ $Z^1_{ayl} = 4.5\ (1.0*12+.9*8)\ 8 = 584.8$ tkm

Yuklarni tashish uchun zarur bo‘lgan avtomobillar soni:

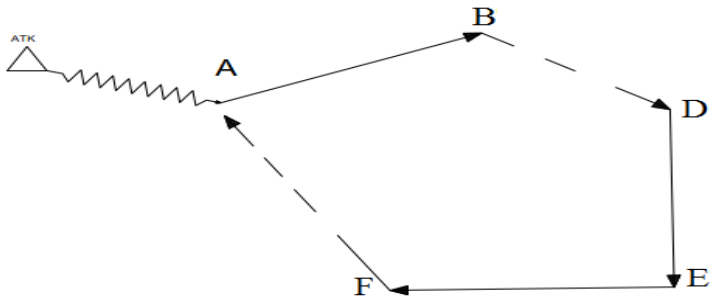
$L_{sut} = (l_{AB}+l_{BV}+l_{BA})*Z + (l_o^1+l_o^{11})-l_{BA} = (12+8+4)*8 + (5+5) - 4 = 198$ km

Kun davomida avtomobilning yo‘ldan foydalanish koeffisienti

$$\beta = \frac{(l_{yuq}^{AB}+l_{yuq}^{BV})\, Z_{ayl}}{L_{sut}} = \frac{(12+0.8)*8}{198} = 0.81$$

## Halqasimon marshrutda transport vositalari ish hisobi

Halqasimon marshrutda yuk tashuvchi avtomobilning ishini hisoblashda (19-rasm) quyidagi birlamchi ko‘rsatkichlardan foydalanamiz.




**9-rasm. Halqasimon marshrut**

Qatnov masofalari oralig‘i

$l_{yuq}^{AB}$ = 10 km

$l_{bq}^{BV}$ = 4.0 km

$l_{bq}^{DA}$ = 6 km

$l_{yuq}^{VG}$ = 14.0 km

$l_{yuq}^{GD}$ = 12 km

$l_o$ = 6 km

Avtomobilning ish vaqti $T_{ish}$ = 16 soat. Qatnovning AB bo‘lagida tashiluvchi 1-sinfga mansub yukning ($\gamma_{AB}$ = 1.0) hajmi 200000 t, VG bo‘lagida 2-sinfga mansub yukning ($\gamma_{VG}$ = 0,8) hajmi 160 000 t va GD bo‘lagida 3-sinfga mansub yukning ($\gamma_{GD}$

= 0,6) hajmi 120 000 t. Tashish muddati $K_E$ =360 kun.Yuk tashishda ISUZU avtomobillaridan foydalaniladi. Yuk ortish vaqgi $t_o$ = 0,5 soat, tushirish vaqti $t_t$ = 0,3 soat. Qatnov sharoitlari ayrim yo‘l bo‘laklarida bir xil emasligi uchun, harakat tezliklari quyidagicha: yo‘lning AB va VD bo‘laklarida $V_T$ = 20 km/soat, BV va VG bo‘laklarida $V_T$ = 22 km/soat va DA bo‘lagida va nolinchi qatnovda $V_T$ = 20 km/soat

Hisoblash tartibi:

1. Avtomobilning marshrutda ishlash vaqtini topamiz:

$$T_M=T_{ish} - \frac{l_o^1+l_o^{11}}{V_T}= 16-\frac{6+6}{20}=15.4$$

Avtomobilning marshrutda to‘liq bir aylanishida harakatlanish va ortish-tushirishda turish vaqtlarining jami:

$$t_{ayl} = \sum t_x + \sum t_{o-t} \text{ , soat (56)}$$

jumladan,

$$\sum t_x = t_h^{AB} + t_h^{BV} + t_h^{VG} + t_h^{GD} + t_h^{DA} = \frac{l_{yuq}^{AB}}{V_T} + \frac{l_{yuq}^{BV}}{V_T} + \frac{l_{yuq}^{VG}}{V_T} + \frac{l_{yuq}^{GD}}{V_T} + \frac{l_{yuq}^{DA}}{V_T} = \frac{10}{24} + \frac{4}{22} + \frac{14}{22} + \frac{12}{24} + \frac{6}{20} =$$

2.04 soat

$$\sum t_{o-t} = t_o^A + t_t^B + t_o^V + t_t^G + t_o^G + t_G^D = 0.5 + 0.3 + 0.5 + 0.3 + 0.5 + 0.3 = 2.4 \text{ soat}$$

U holda:

$$t_{ayl} = 2.04+2.4=4.44\text{soat}$$

2. Avtomobilning marshrutdagi bir kunlik aylanishlar soni:

$$Z_{ayl} = \frac{T_M}{t_{ayl}} = \frac{15.4}{4.44} = 3.4$$

Aylanishlar sonini yaxlit 3 ga keltirib, vaqt sarflarini qayta hisoblaymiz:

marshrutdagi vaqt

$$T_M^1 = t_{ayl} \qquad Z_{ayl}^1 = 4.44 \qquad 3.0=13.32 \text{ soat}$$

ishda bo‘lish vaqti

$$T_{ish} = T_M^1 + t_o = 13.32+0.6=13.92 \text{ soat}$$

3. Avtomobilning bir kunlik ish unumini hisoblaymiz:

tonnada

$$Q_K = (q_n \gamma_{AB} + q_n \gamma_{VG} + q_n \gamma_{GD}) \; Z_{ayl}^1 = q_n (\gamma_{AB} + \gamma_{VG} + \gamma_{GD}) \; Z_{ayl}^1 = 5$$

(1+0.8+0.6)*3=36 t

tonna-kilometrda

$$P_K = (q_n \gamma_{AB} l_{yuq}^{AB} + q_n \gamma_{VG} l_{yuq}^{VG} + q_n \gamma_{GD} l_{yuq}^{GD}) Z_{ayl}^1 = q_n (\gamma_{AB} l_{yuq}^{AB} + \gamma_{VG} l_{yuq}^{VG} + \gamma_{GD} l_{yuq}^{GD})$$

$$Z_{ayl}^1 = 5 \; (1*10+0.8*14+0.6*12)*3 = 426 \text{ tkm}$$

Yuklarni tashish uchun zarur bo‘lgan avtomobillar soni

$$A_E = \frac{Q_{AB}+Q_{VG}+Q_{GD}}{K_E Q_K} = \frac{200000+160000+120000}{360*36} = 37$$

4. Avtomobilning bir kunlik umumiy qatnov masofasi:

$$L_{sut} = L_{ayl} Z_{ayl}^1 + l_o + l_{bq} = (l_{yuq}^{AB} + l_{bq}^{BV} + l_{yuq}^{VG} + l_{yuq}^{GD} + l_{bq}^{DA}) Z_{ayl}^1 + l_o + l_{bq} =$$

$$=(10+14+12+4+6)*3+(6+6)-6=144\text{km}$$

Yo‘ldan foydalanish koeffisienti:

$$\beta = \frac{l_{yuq.ayl} Z_{ayl}^1}{L_{sut}} = \frac{(l_{yuq}^{AB} + l_{yuq}^{VG} + l_{yuq}^{GD}) Z_{ayl}^1}{L_{sut}} = \frac{(10+14+12)*3}{144} = 0.75$$

## Nazorat uchun savollar

1. Ikki tomonlama yukli qatnovchi mayatnikli marshrutda transport vositasining tonna-kilometrdagi ish unumi qanday hisoblaniladi?
2.Ikki tomonlama yukli qatnovchi mayatnikli marshrutda transport vositasining kunlik qatnov masofasi qanday hisoblaniladi?
3. Orqa yo‘nalishda qisman yukli marshrutda transport vositalarining bir kunlik ish unumini hisoblang.
4. Orqa yo‘nalishda qisman yukli marshrutda yuklarni tashish uchun zarur bo‘lgan avtomobillar sonini hisoblang.
5. Halqasimon marshrutda transport vositalarining bir kunlik ish unumini tonna-kilometrda hisoblang.
6. Halqasimon marshrutda transport vositalarining bir kunlik umumiy qatnov masofasini hisoblang.