

**MAN CLA 16.220 AVTOMOBILINING TORMOZLANISH
XUSUSIYATINI NOQULAY OB-HAVO SHAROITLARIDA HISOBLASH**

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Anotatsiya Tormozlanish xususiyati tormoz tizimlarining ishi bilan ta'minlanadi. Amalda bo'lgan davlat standartlariga asosan avtomobillar uchta majburiy tormoz tizimlari bilan (ishchi, to'xtatib turish va zaxira) jixozlanadi. Og'irligi 12t.dan ortiq avtomobillar yoki tog'lik rayonlarda foydalanishga mo'ljallangan avtomobillar esa yordamchi tormoz tizimi bilan ham jixozlanishi lozim.

Kalit so'zlar: avtomobil, tormozlash, qiyalik, tog'li yo'llar.

**ENSURING THE SAFETY OF A CAR THAT HAS CRASHED WHILE
DRIVING IN MOUNTAINOUS AREAS.**

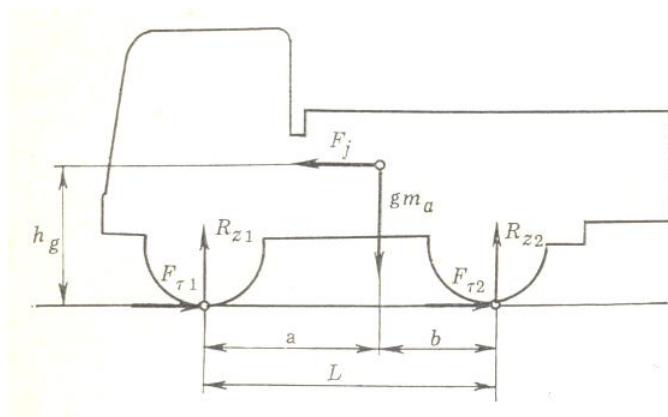
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Annotation: The braking feature is provided by the operation of the brakes. According to current state standards, cars are equipped with three mandatory braking systems (working, stopping and spare). Vehicles weighing more than 12 tons or intended for use in mountainous areas must also be equipped with an auxiliary brake system.

Keywords: car, braking, slope, mountain roads.

Mamlakatimiz iqtisodining jadal rivojlanishi avtomobil transportida yuk va yo'lovchi tashish jarayoniga kyeng imkoniyatlar yaratib byerish bilan bir qatorda mamlakatimiz yo'llarida transport oqimining murakablashishi, buning natijasida yo'l-transport hodisalarining soninning ko'payishiga ham sabab bo'lmoqda. Yo'l-transport hodisalarini va haydovchi, yo'lovchi, piyodalarning havfsizligini ta'minlashda salmoqli o'rin kasb etgan avtomobilning tormoz xususiyatini *MAN CLA 16.220* avtomobilining misolida hisob ishlarini olib boriladi.

Tormozlanish vaqtida avtomobilga ta'sir etuvchi kuchlar 2-rasmda ko'rsatilgan. Avtomobilning sekinlashishini ta'minlaydigan kuchlar bo'lib, g'ildi-rak va



yo'l orasida xosil bo'ladigan tormoz kuchlari P_{T1} va P_{T2} xisoblanadi. Ular avtomobil harakatiga qarama-qarshi yo'nalgan bo'ladi.

2-rasm. Tormozlanish vaqtida avtomobilga ta'sir etuvchi kuchlar

Tayanch tekisligiga parallel tekislikka proeksiya qilingan kuchlarning summasi inersiya kuchiga teng:

$$\delta_T \cdot M_a \cdot j_c = P_{T1} + P_{T2} + P_{f1} + P_{f2} + P_i + P_w; \quad (4)$$

bu erda: M_a - avtomobil massasi, kg

j_c - avtomobilning sekinlashishi, m/s^2

δ_T - tormozlanish vaqtida aylanuvchi massalarni hisobga olish

koeffitsienti

$$(\delta_T = 1,03 \dots 1,05)$$

P_{T1} va P_{T2} - oldingi va orqa g'ildiraklardagi tormoz kuchi, N

$$P_{Ti} = \varphi \cdot R_{Zi};$$

P_{f1} va P_{f2} - oldingi va orqa g'ildiraklarning g'ildirashga qarshilik

kuchi, N

$$P_{fi} = f \cdot R_{Zi};$$

P_i - balandlikka chiqishga qarshilik kuchi, N

$$P_i = M_a \cdot g \cdot i;$$

P_w - havoning qarshilik kuchi, N

$$P_w = K \cdot F \cdot V_a^2;$$

Quyidagicha belgilashlar kiritamiz: $P_{T1} + P_{T2} = P_T$; $P_{f1} + P_{f2} = P_f$; u holda:

$$\delta_T \cdot M_a \cdot j_c = P_T + P_f + P_i + P_w; \quad (5)$$

Berilgan avtomobil uchun $j_c = f(v_a)$ ni qurishda ikki xil tormozlanish re-jimi ko'rib chiqiladi, ya'ni avtomobil faqat tormoz tizimi yordamida tormoz-langanda hamda avtomobil tormoz tizimi va dvigatel bilan birga tormozlan-ganda avtomobilning sekinlashishi aniqlanadi.

Agar avtomobil faqat tormoz tizimi yordamida tormozlansa sekinlashish quyidagicha aniqlanadi:

$$j_{c_T} = \frac{P_T + P_f + P_i + P_w + P_{xx}}{G_a \cdot \delta_H} \cdot g, \quad \text{m/s}^2; \quad (6)$$

bu erda: P_{xx} - avtomobil nakat bilan xarakatlanganda tranmissiyadagi qarshilikni engishga

sarflanadigan kuch; (etakchi g'ildiraklarga keltirilgan), N

$$P_{xx} = (2 + 0,025 \cdot V_a) \cdot M_a \cdot g \cdot 10^{-3};$$

G_a – avtomobil og'irligi; N

$$G_a = M_a \cdot g$$

δ_H - avtomobil nakat bilan harakatlanganda aylanuvchi masalalarni xisobga

$$\text{oluvchi koeffitsient: } \delta_H = 1 + \frac{I_k}{G_a \cdot r^2} \cdot g \approx 1 + \delta_2;$$

Agar avtomobil tormoz tizimi va dvigatel bilan birga tormozlansa se-

kinlashish quyidagicha aniqlanadi: $j_{c_{TD}} = \frac{P_{TD} + P_T + P_f + P_i + P_w + P_{xx}}{G_a \cdot \delta_{bp}} \cdot g, \quad \text{m/s}^2;$

bu erda: P_{TD} – dvigatelning umumiy ishqalanish kuchi (etakchi g'ildirakka keltirilgan), $P_{TD} = \frac{M_{TD} \cdot u_{TP}}{r \cdot \eta_{TP}};$

M_{TD} – dvigatelning umumiy ishqalanish momenti, $H \cdot M$

$$M_{TD} = V_n (a_1 \cdot n_{ei} - b_1) \cdot g;$$

$a_1=0,0008$, $b_1=0,15$ – benzinli dvigatellar uchun

$a_1=0,001$, $b_1=0,2$ – dizel dvigatellari uchun

V_n – dvigatel litraji, l

n_e – dvigatel valining aylanishlar soni, ayl/min

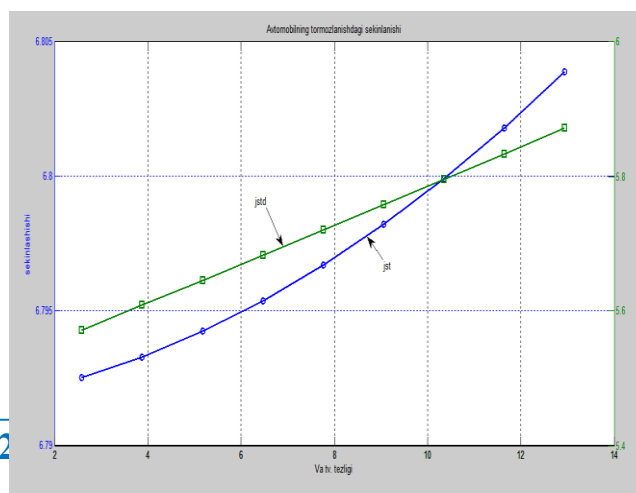
δ_{ep} – dvigatel bilan birga tormozlangandagi aylanuvchi massalarini xisobga olish

$$\text{koeffitsienti; } \delta_{ep} = 1 + \frac{I_M \cdot u_{TP}^2 + I_k}{G_a \cdot r^2} \cdot g \approx 1 + (\delta_1 \cdot u_{KII}^2 + \delta_2);$$

$$\delta_1 = \frac{I_M \cdot u_{zi}^2}{G_a \cdot r^2} \cdot g \approx 0,04 \dots 0,06;$$

$$\delta_2 = \frac{I_k}{G_a \cdot r^2} \cdot g \approx 0,03 \dots 0,05;$$

Avtomobilning tormoz tizimi va dvigatel bilan birga tormozlanishi $j_{c_{TD}}$



$> j_{c_T}$ sharti bajarilgandagina maqsadga muvofiq. Avtomobilning tormozlanish tezligi katta bo'lganda P_{TD} ning qiymati ham katta bo'ladi, shuning uchun $j_{c_{TD}} > j_{c_T}$ bo'ladi. Lekin δ_{ep} doimo δ_H dan katta bo'lgani uchun avtomobilning tormozlanish tezligi kichik bo'lganda $j_{c_{TD}} < j_{c_T}$ bo'ladi. Ikkita egri chiziqning ke-sishish nuqtasining absissa o'qidagi proeksiyasi avtomobilning tormoz tizi-mi va dvigatel bilan birga tormozlanishi maqsadga muvofiq bo'lgan minimal tezlikni ko'rsatadi.

Tormozlanish vaqti deb, avtomobil barqaror sekinlashish bilan to'xtayotganda sarf etilgan vaqtga aytiladi. Uning qiymati yuqorida keltirilgan formula yordamida aniqlanadi, ya'ni:

$$t_T = \frac{V_a}{3,6 \cdot j_c} = \frac{V_a \cdot k_3}{3,6 \cdot g \cdot \varphi}, \quad c;$$

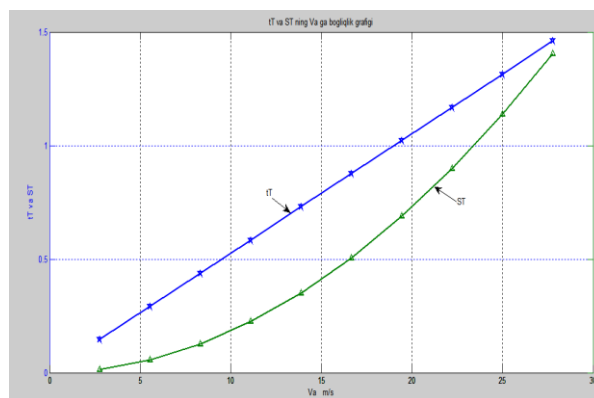
Tormozlanish yo'li deb, tormozlanish vaqtida bosib o'tilgan yo'lga aytiladi. U quyidagicha aniqlanadi:

$$S_T = \frac{V_a^2}{26 \cdot j_c} = \frac{V_a^2 \cdot k_3}{26 \cdot g \cdot \varphi}, \quad m;$$

Berilgan avtomobil uchun t_T va S_T ning v_a ga bog'liqlik grafigini qurishda ikki xil tormozlanish rejimi hisoblanadi:

- 1) g'ildiraklar blokirovkalanish arafasida tormozlanganda ($\varphi=0,7$);
- 2) blokirovkalanган g'ildiraklar bilan tormozlanganda ($\varphi_b=0,8 \varphi$).

t_T va S_T ning v_a ga bog'liqlik grafigi chiziladi:



MAN CLA 16.220 avtomobilning tormozlanish xususiyarini hisoblash ishlari olib borildi bunga kora:

$V_a = 50$ km/soat tezlik bilan harakatlanayotganda $\varphi=0.7$ bo'lganda $j_s = 5.28$ va to'htash vaqti $t_t = 4.32$ s

Avtomobilning tormozlanish tezligi katta bo'lganda P_{TD} ning qiymati ham katta bo'ladi, shuning uchun $j_{c_{TD}} > j_{c_T}$ bo'ladi. Lekin δ_{ep} doimo δ_H dan katta bo'lgani uchun avtomobilning tormozlanish tezligi kichik bo'lganda $j_{c_{TD}} < j_{c_T}$

bo'ladi. n_{emax} qiymatda va uzatmalar qutusi 3-pog'onada harakatlangan vaqtida $j_{CTD} = 5.87 \text{ m/s}^2$ $j_{CT} = 6.8 \text{ m/s}^2$ sekinlashish qiymatlariga erishdi chunki bu vaqtda tezlik $V_a = 12.9 \text{ m/s}$ qiymatni qabul qilgandi.

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